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Think of Your Scrap in Terms of Productive Labor

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Round-table discussions—Establishing contact between management and shop men—Control of non-productive labor—Revised duties of foremen—Enlarged scope of employment department

SOME engineer or other once said, "Let me see your scrap pile and I'll tell you how efficiently you run your business." If he meant his statement to be taken literally he probably was overestimating his abilities. Beside seeing the scrap pile he would have had to make investigations to learn how long the scrap had accumulated; the tolerances to which it was necessary to manufacture the product; the volume of output of the factory; labor conditions, so far as they were beyond the control of management; the material or raw-product limitations where they were not under the control of the consumer; and the shortcomings of management in not taking those preventive measures within its power, because of ignorance, indolence, or lack of competition.

In expanding upon the factors influencing scrap, as enumerated in the preceding paragraph, and so far as they bear upon this article, the time of accumulation may be dismissed. Whether scrap is disposed of daily, weekly, monthly or yearly depends largely upon its physical proportions, and an accumulation over a long period would be no positive indication of inefficient management.

The effect of tolerances is great. It is readily conceivable that a simple commodity with wide tolerances could be produced by one concern that would have a scrap pile of huge proportions. A comparable product might be turned out by another concern with almost negligible scrap. The difference would be due to the existence or non-existence of poor material, poor workmanship, ignorant labor, improper management, competition. The two hypothetical cases just outlined may be paralleled by two others wherein two manufacturers of comparable precision products accomplish their production with much or little scrap. These are extreme cases, but they are possibilities.

The most likely explanation for the continued existence of a business with a high scrap ratio would be lack of competition, because in the long run makers of the same kinds of products are subject to the same variations in material and labor. If not, the less fortunate must accept smaller profits or withdraw from the field. However, there are few products not subject to competition, a fact that justifies the elimination of "no competition" as a controlling factor. This elimination makes evident the correctness of the assumption that the producer of the wide-tolerance commodity will have less scrap than the producer of the close-tolerance commodity, when output is on the same scale.

The influence of the volume of output upon proportion of scrap is a variable that commands respect. It is a peculiar variable, sometimes effecting a reduction and at other times an increase in scrap. Small output may prevent the acquisition of fixtures and gages and the employment of inspectors on a rough class of product with a resultant high scrap. The workmen would be doing the best they could with their limited facilities. On precision work it may eliminate haste and give to the high type of workman necessarily employed the opportunity for full use of the measuring instruments with which he is obliged to be provided and the scrap will be nil.

Large output on the rough work might make possible the acquisition of a complete equipment of fixtures, tools and gages and the employment of a competent crew of inspectors, and scrap would be low. On precision work large output might necessitate so much speed that, although the equipment, fixtures and gages

AS ITS share of the plant activities in reducing scrap, management must do these things:

Organize and educate those members of the factory organization in authority who are responsible for scrap, so that causes of scrap may be definitely determined.

Bring about proper co-operation between the factory organization and the accounting organization.

Present the whole subject of scrap to the individuals performing the manufacturing operations, in a manner that will permit a thorough understanding of the problems.

A cost system, properly planned and efficiently operated, must ante-date these activities.

were of the best, the scrap would be high. It is a problem of management to strike the desirable medium.

The next factor is labor, the quality of which is less under the control of management than are any of the other variables being considered. The quality of labor is affected by many things: General locality, accessibility of plant; competition of other industries; weather; our position on the business cycle; and so on. The nearer the approach to control of the other factors influencing scrap, the more important becomes the control of what the workman does in the plant.

Selection of material and control of specifications are largely matters of engineering, purchase and analysis. Research will discover the best material to be used. trial will determine the source of supply and analysis will insure the maintenance of specifications. Even so, in the manufacture of materials, there are physical limitations that cause the delivery of defective material to be discovered only after the product is in process, frequently as the shop work is nearing completion. To the extent that unpreventable defects enter into material, the scrap caused by them is beyond the control of management.

The factor of the shortcomings of management, in not taking preventive measures, enumerated last, is one that theoretically can be eliminated. To be sure, the other factors influence it, and to the extent that there occur effects not previously encountered, the elimination will not be complete.

The purpose of this article is to show some of the steps taken by one manufacturer to reduce scrap traceable directly to management, and the preceding explanatory statement of the causes of scrap are made to provide a background against which to visualize the results.

The company is the Hess-Bright Manufacturing Co.,

Comparative Scrap Report

Month of_____

Department No.	Name	Productive Labor	Cost of Scrap: This Oper.	Previous Oper.	Setting Up	Defective Material	Total	Ratio of the Cost of Scrap to the Productive Labor: This Oper.	Prev. Oper.	Set Up	Def. Mat.	Total	Number of Pieces Scrapped: This Oper.	Prev. Oper.	Set Up	Def. Mat.	Total	Pieces Operated	Scrap Budget: Incr. or Decr. of Actual to Budget This Month	Increase or Decrease to Date
	Cleveland Auto																			
	Turret Lathe																			
	Engine Lathe																			
	Stamping																			
	Nat. Acme																			
	Gridley Auto																			
	Pratt & Whitney																			
	Bright Lathes																			
Machining Depts.	Feb.																			
	Jan.																			
	Surface Grind																			
	Bore Grind																			
	Landis Groove Grind																			
	Polishing																			
	O. D. & Landis Grind																			
	Van Norman Groove Grind																			
	Rivett Groove Grind																			
	Inner Groove Grind																			
Grinding Depts.	Feb.																			
	Jan.																			
	Forging																			
	Hardening																			
	Cage Stamping																			
	Assembling																			
	Cage Machining																			
Total Production Scrap	Feb.																			
	Jan.																			
Miscellaneous Scrap	Feb.																			
	Jan.																			
Loss due to Disassembling	Feb.																			
	Jan.																			
Scrap Loss from Bearings disassembled from Stock	Feb.																			
	Jan.																			
Total Loss for the Month	Feb.																			
	Jan.																			

Fig. 1—A report that forms the basis for discussion at monthly round-table meetings

of Philadelphia, a branch of SKF Industries, Inc., and the product consists of assembled ball bearings. All parts except the balls are produced in the Hess-Bright plant. The product is of the precision type, requiring close tolerances and high-quality materials, and the volume of output is large.

For the purposes of this article the factors influencing scrap, with the exception of the activities of management as they affect labor, are to be considered constant. The time of accumulation of scrap will be disregarded because the volume of scrap by weight is not considered. Tolerances are established and therefore are constant. The volume of output depends upon sales and is kept as large as possible. The type of labor available is average and on account of the locality changes but slowly. Long experience has determined material specifications and thorough laboratory analysis checks the materials delivered.

Cost of This-Operation Scrap

Week Ending _____
O. D. Grinding

Operator's No.	Operator's Name	Pieces Finished	Pieces Scrapped	Cost of Scrap	% of Total Cost of Scrap

Fig. 2—By this report the foreman is enabled to show to operators the true cost of scrap

Scrap is figured in dollars and cents, as well as in quantity of bearings or components. It is not figured in pounds. An incomplete story would be told by saying that of every 1,000 lb. of bearings made 10 lb. was scrapped, or by saying that of every hundred bearings made one was scrapped. It makes a difference whether the pounds of scrap or the quantity of scrap by units is composed of large or small bearings.

The cost of productive labor is a measure of the work going through the shop and if the value of the scrap is expressed as a percentage of the cost of productive labor there is obtained a true picture of the efficiency of both labor and equipment. It is on such a basis that scrap is figured.

The accompanying illustrations show the most important of the forms used to report scrap losses to the management. Reports made on the monthly "Comparative Scrap Report," Fig. 1, form the basis for discussion at monthly round table meetings. The men present include the factory manager, the heads of the inspection, production, planning and time-study departments, the comptroller, a cost representative from the accounting department, a shop cost accountant, the general foremen of the turning and grinding departments, several of the sub-foremen and the employment manager.

Daily Inspection Report

Bore Grinding

Date Inspected_____

Date	Oper. No.	Oper. Name	Brg. Size	Quan. Fin.	Scrap				Work to be Reoperated	Def. Passed
					Large	Taper	Black	Total		

Fig. 3—A report that is a daily check on the operator's output

The group meets once a month at dinner provided by the company and after dinner returns to the office for a two-hour session on scrap.

The factory manager presides at the meetings and with the comparative scrap report as a guide asks the foremen to tell him just why more of their productive labor on certain operations went into scrap during the current month than found its way there during the preceding month. He also asks the same men how they reduced their scrap in other departments. Each man at the meeting has a copy of the report and sees the results of his work in dollars and cents. There is no attempt at secrecy and the foremen are privileged to carry the figures to their men in the shop if they deem it advisable to do so.

It is easy to see that criticisms of routing, scheduling, rates, costs and labor may arise. Hence the presence of the men heading the departments controlling those divisions of the plant activities.

The comparative scrap report almost explains itself, yet there are a few headings that require comment. Scrap listed under "This Operation" is scrap actually caused by the operation referred to. Scrap listed under "Previous Operation" is scrap discovered at "this operation," but on which the defects resulted from some previous operation. The cost charged to "Setting Up" is the cost of those pieces spoiled in getting the machine ready for the operation—setting the tools, stops and so on. Figures on number of pieces scrapped and pieces operated are given as a check against the cost figures and as information that it is desirable for the foremen to have in front of them. It will be noticed that there is a budget allowance for scrap. The budget figures are based on the scrap of the preceding year, with due allowance for betterment. For 1925 they are 25 per cent less than the cost of scrap during 1924.

Scrap on Cleveland Automatics

Week Ending _____
Inner

This Operation					Prev. Oper Deft. Matl.			
Brg. No.	TM	SOD	NW	LB	Bar Ends	Deft. Matl.	Small Bar Stock	Total
Totals								

Fig. 4—A measure of the efficiency of department and supervision

The monthly comparative scrap report of itself would not suffice to point out all of the facts about scrap that it is desirable and necessary to know. The foreman must be able to concentrate on the individuals making the scrap. Nor will it suffice for a foreman to go to an operator and tell him in a general way that he is making too much scrap. The foreman must be able to show just how much scrap has been made, how much the operator has lost in wages that he didn't get and how much the company has lost in the scrap he made. The weekly report, "Cost of This-Operation Scrap," Fig. 2, serves the purposes outlined. It is made out for operations such as outside-diameter grinding, bore grinding, automatic-machine work, and so on. This report is a weekly check on the operator. It is one of three such checks, the others being a daily efficiency report, showing the operator's output and the estimated

output that he should achieve and the daily inspection report, Fig. 3, that shows actual scrap.

The daily efficiency report of a given day's work is compiled during the morning of the following day and is delivered to the operator's foreman.

The daily inspection report is made for each of the important operations and the entries are made opposite operators' names. This report is distributed about 10 o'clock each morning. It places in the foremen's hands exact reports of what their men did on the pre-

O. D. Grinding Scrap

Week Ending _____

This Operation				Previous Operation	
Brg. No.	Out of Round	Under Size	Burned in Grinding	Black	Total

	This Week	Last Week
Total Rings operated		
Total Rings rejected		
% of Rejections		

Fig. 5—A report the same in function as that shown in Fig. 4

ceding day and if there are glaring amounts of scrap, the fault can be remedied at once. These close-ups of a man's work so soon after it is done are unusual forms of control and have an appreciable effect on scrap.

As a comparison chart and as a measure of the operator, the daily efficiency report and the daily inspection report work well, but they are not a measure of the efficiency of the department and of supervision (the foremen). Therefore scrap reports by departments are made. Two of them are shown in Figs. 4 and 5. They are the weekly reports of scrap on automatic machines for inner and outer race work, and of the grinding operations, outside diameter, bore and groove. Where more than one type of machine is used on the same or similar operations these reports furnish a check on machines as well as men.

(To be concluded)

Grinding Wheels and Precious Stones —Discussion

In a short article under the title given above, published on page 416, Vol. 62 of the *American Machinist*, artificial aluminous oxide, an abrasive material widely employed in the manufacture of grinding wheels, was referred to by one of its many trade names.

A correspondent calls attention to the fact that, owing to the great variety of pseudonyms under which this very useful material masquerades, some of our readers who may be quite familiar with artificial aluminous oxide might not recognize it by that particular title. We therefore append a list of the names by which it is known to the trade.

The names, taken from a list previously published in the *American Machinist*, are as follows: Alowalt, Aloxite, Aluminoid, Alundum, Bathite, Boro-Carbone, Borolon, Clevite, Excelite, Hytens, Natalite, Orelite, Oxaluma, Oxylum, Rex, Rexite, Staralox, Sterlite.

Who Wastes the Most Time?

By Alfred T. Gregory

"Bill," said John, one night after the day's work was over, "who wastes the most time in the shop?"

"Hm," replied Bill, "now you've asked me a question that is hard to answer. I dare say there are few men who can rightly answer it.

"There's old Henry, the boss of the locomotive tool shop, who reminded me of a cyclone when he brought around a job. He scattered everything he found in his way and when he was gone I had to hunt around for all my tools. Then I had the devil's own job in trying to figure out what he wanted done. I don't think he saved very much time for the company."

"Well, there's George Armstrong down at Sim's plant," came back John. "I never worked for a finer boss. He'd come around and talk to you, and he made you feel as if he were your brother. He has worked out a number of time saving devices and methods that have nearly doubled the production in his department."

"But the trouble down there is that old Smith, the superintendent, is such an efficiency bug," said Bill. "To him every job is a rush job, and if you rushed it through for him, it is ten chances to one that it will lay around fully a week before they come after it.

"You know, John, this efficiency business is all right in a way, but the manner in which that man Smith goes at it costs more than it saves. He would be a very different executive if he could only realize that the delays and the loss of time through lack of system and misguided economy, delays for which he is responsible, are by far the largest items on his debit sheets. If one of our belts should break, we have to hunt all over the shop for a cranky old belt man. He will come when he gets ready, and woe betide the man who asks for a new belt no matter how badly he needs it. Such luxuries can't be afforded.

"There seems to be a constant fight among the milling machine hands for straps, bolts, nuts and so on, because the stockroom refuses to give out any more. They had orders to cut down expenses. You haven't even begun to think along the lines of efficiency until you supply your workmen with the proper tools, and plenty of them, until you see that your machinery and equipment is in good repair, and until your work is properly systematized, planned and handled.

"I heard a good one the other day. They had a real scrap over in the pipe shop. The toolroom foreman received some drawings for tools. They were made from tracings that were worn and dirty and so were hardly legible. He went to the factory manager and told him that if he didn't receive good drawings he couldn't make good tools. The chief engineer protested that it would cost too much and would necessitate putting on a new man. But the toolroom foreman argued that it was a case of the engineer's getting a new draftsman for about six months, or hiring three new toolmakers permanently. He won the decision. The chief engineer ordered the worn tracings to be made over.

"Other things being equal, John, I should say that the amount of time a fellow wastes or saves is proportional to his responsibility. Whether he runs a machine or whether he is a foreman or superintendent, the most efficient man is the fellow who knows his business and who uses a lot of 'horse sense' in carrying it out."

Automotive Production

How Crankshafts for Diesel Engines Are Machined

By Fred H. Colvin
Editor, *American Machinist*

The operations and methods used in finishing large crankshafts to a high degree of accuracy — Special steady rests and crankpin turning machines

ONE of the problems in Diesel-engine manufacture has been to secure crankshafts that will stand up satisfactorily under the heavy duty to which they are subjected, and having produced the forgings as shown in a previous article, the next problem is to machine them accurately and efficiently so as to secure satisfactory production costs. There are twenty-one operations in producing the Fairbanks, Morse & Co. crankshafts at Beloit, Wis.

After forging, the crankshafts, as shown in Fig. 1, are placed on V-blocks mounted on a surface plate and the alignment set so as to insure cleaning up at all points. The crankpins are then laid off and lines made to designate the starting point for the initial operation. The roughing operation is done in a 60-in. Pond lathe having two carriages, as shown in Fig. 2. The end journal is first turned for a steadyrest, and a cut started while the opposite end is being spotted for a steadyrest at that point. The diameters are left 1¼ in. oversize and the webs faced so that ⅜ in. is left on each side for finishing.

As soon as the bearings are spotted, the steadyrests are put in place. With the journals rough turned, the crankshaft is ready to have the throws drilled and the blocks cut out preparatory to turning the crankpins. The crank throws are carefully drilled by means of suitable guides, the size of drill being chosen so as to leave a 1/32-in. wall between the holes. This requires very careful grinding of the drill and the holes are drilled very straight through webs 10 in. thick. The drilling is done on the radial drilling machine shown in Fig. 3, the spacing of the holes being indicated in Fig. 4. The time required for drilling the thirty-six holes necessary in a 6-throw crankshaft is four hours. This time includes the handling of the shaft between operations, or what is known as floor-to-floor time.

Fig. 1—Crankshafts in the rough

The Operations

1—Layout and center
2—Rough-turn journals
3—Drill holes for wrists
4—Saw out throw-blocks
5—Rough-turn pins 1¼ in. oversize
6—Heat-treat
7—Drill for test bar
8—Turn and thread test bar
9—Pull test bar
10—Saw ends for overall length
11—Layout and recenter
12—Second rough turn
13—Spot and recenter
14—Turn journals
15—Turn tops of webs
16—Turn pins ⅛ in. oversize (with throw blocks on centers)
17—Finish-turn journals and polish
18—Finish-turn pins and polish
19—Plane webs (when necessary)
20—Mill keyways
21—Drill and tap complete

Following the drilling of the holes, the crankshaft goes to the heavy-duty cold saw, located next to the radial, as in Fig. 4. Here two 36-in. inserted-tooth saws cut down to the drilled holes in the six webs in 3¾ hr. The blocks are then drifted out with steel wedges.

With the crank webs supported in an eccentric steadyrest of special design, and with special offset-center spiders on

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each end of the shaft, both the crankpins and the ends of the webs are turned, as in Fig. 5. It will be seen that there are two sets of centers in each arm of the spider, the inner holes being used for the ends of the webs and the outer ones for the crankpins. A close-up view shows the construction of the eccentric steadyrest

rests. This turning reduces the shaft to within $\frac{1}{2}$ in. of finished diameter and the webs are faced to within $\frac{1}{8}$ in. of finished size on the sides. It is necessary, however, that the web measurements be accurately maintained, as all future shoulder measurements and the finished operations are dependent upon accuracy at these

Fig. 2—The first turning operation

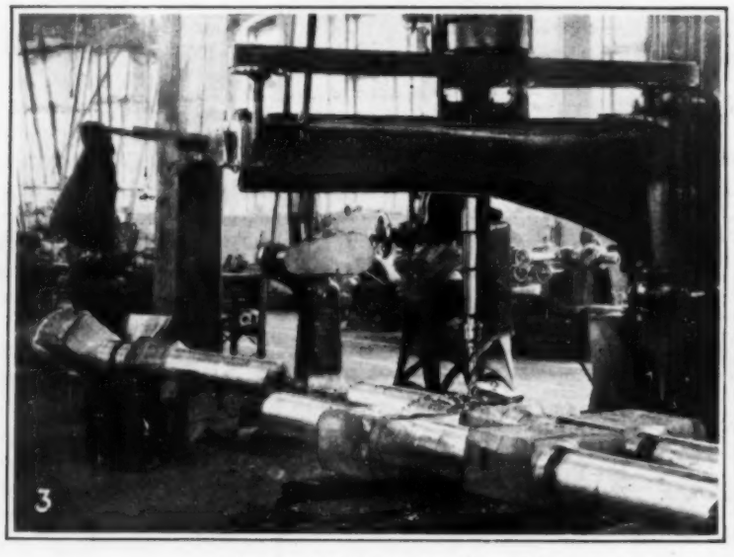
in Fig. 6, which also shows how both the journals and the webs are supported by screws. The crankpins are rough-turned $1\frac{1}{4}$ in. oversize to allow for future operations. The turning requires 12 hr. for a 6-throw shaft.

The crankshaft is then returned to the forge shop for heat-treatment and to have a test bar cut from the end, as was shown in a previous article. The test bar is then turned, threaded and pulled, after which, if the heat-treatment is correct, the ends are sawed to the right overall length.

Then the crankshaft is returned to the machine shop where it is recentered and again laid out, and all crankpins and journals given a second rough turning. These operations involve a careful respotting for the steady-

points. The journals are again turned this time to $\frac{1}{16}$ in. oversize, preparatory to the next crankpin roughing operation.

The ends or tops of the webs are next turned, using the eccentric steadyrest shown in Figs. 5 and 6. The correct location for the central locating point that supports the journal bearing in the eccentric steadyrest, has been determined by a series of experiments in which all the various elements were considered. The necessity for care in this particular is indicated by the fact that in a crankshaft of this size and length, the sag due to its weight is approximately $\frac{3}{8}$ in. The crankpin diameters are left $\frac{1}{2}$ in. oversize for the finishing operation, this being accomplished in about 12 hr. on the 60-in. crankpin-turning machine shown in Fig. 7 and



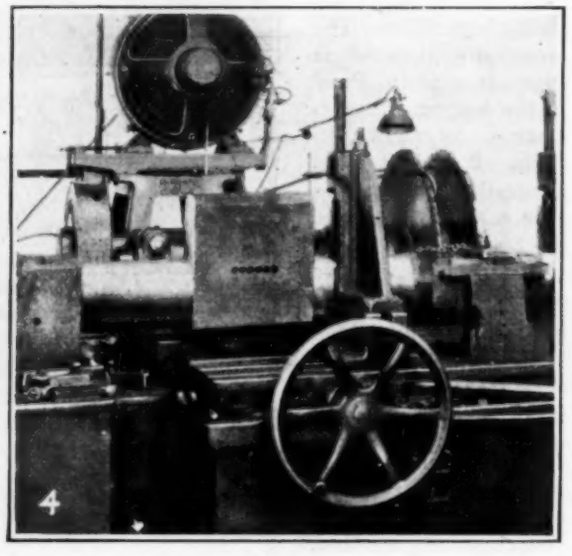


Fig. 3—Drilling out the webs. Fig. 4—Sawing the blocks for crank throws

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manufactured by Johann Moll of Augsburg, Germany.

In this machine, the crankshaft is held in a fixed position, while the cutting tool revolves around the crankpins and at the same time feeds along so as to turn their entire length. A close-up view of the cutting head is shown in Fig. 8, the turning tool being held at recess $\frac{1}{32}$ in. deep is turned on each side of the point where the steadyrest jaws are to bear. A Webber crankpin turning tool is then used to secure a round spot for the steadyrest bearing. Both the tool and the recess-turned side of the bearing can be seen in Fig. 9. This view also shows how the end of the tool is sup-

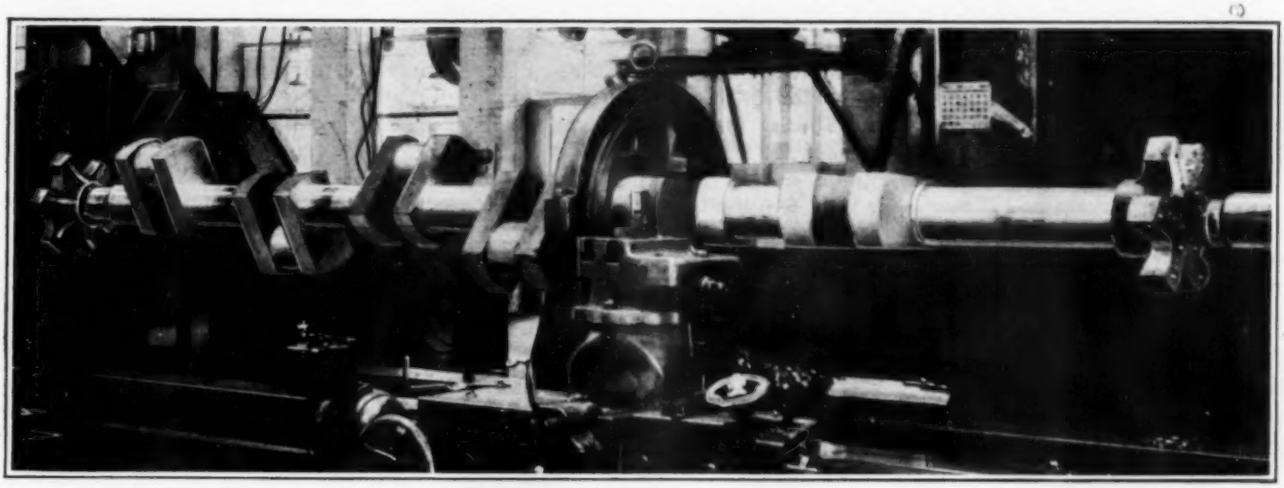


Fig. 5—Turning ends of crank webs

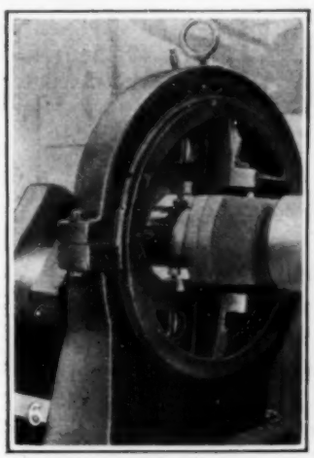
A. Provision is made for a second turning tool on the opposite side, but it has been found more satisfactory to use the single tool as shown.

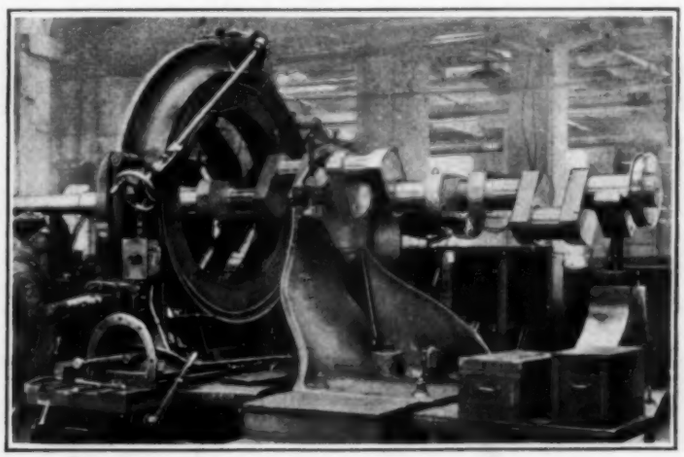
With this machine it is, of course, necessary to locate the crankshaft correctly, so as to bring the different crankpins in proper relation to each other and in parallel with the shaft journals. Suitable means of supporting and locating the shaft are provided, as may be seen in Fig. 7. The approximate turning time is 12 hr. for the six crankpins.

The finish turning and polishing of the journals are operations that require great skill in order to secure the desired accuracy. It is all important that the sag of the shaft be eliminated in order to secure proper alignment, and five spots for steadyrests are turned, that must be concentric within 0.002 inch.

In turning the final "spotting" for the steadyrests, a ported on the piece of round stock laid in the slot of the tool block, and in connection with Fig. 10, will show both the construction and action of the Webber tool. The cutter at *A* and the lower support *B* complete the three bearing points necessary, acting on much the same principle as the centerless grinder. Although this tool was originally designed for automobile-crankshaft work, it has been found very satisfactory on work up to 10 in. in diameter.

After the shaft has been spotted, four steadyrests are used, as shown in Fig. 11, in order to secure the desired accuracy. The journals are then finish turned, allowing approximately 0.003 in. for the polishing operation. When the first journal has been turned, a steadyrest is applied to it, and so on until the crankshaft is completed, the entire turning time being approximately 34 hr. on a 6-throw crankshaft.





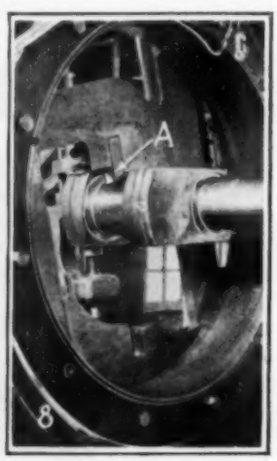


Fig. 6—Details of eccentric steadyrest. Fig. 7—Turning crankpins on Moll machine
Fig. 8—Details of turning head

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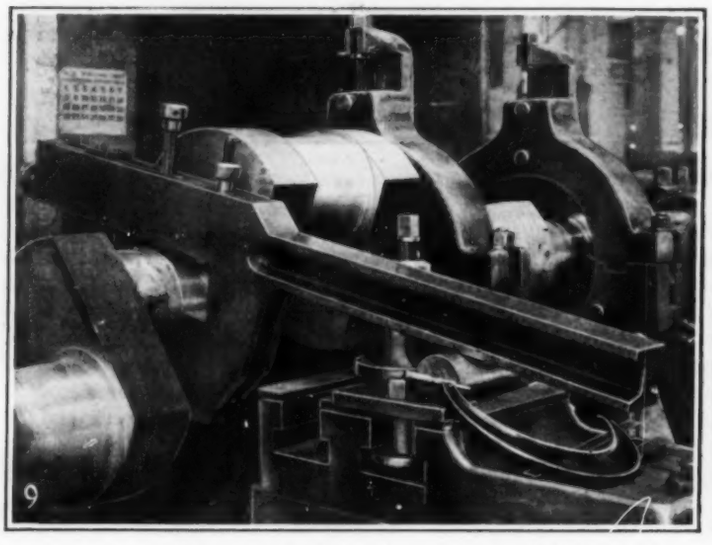
The crankpins are finish turned on the same Moll machine used in the final roughing operation. An indexing drum with lines showing the proper spacing for the various crankpins, is put on the end of the crankshaft, and a plumb line suspended from a center head shows when the crankpin is in proper position for turning.

A right- and left-hand turning tool, as shown at *A*, Fig. 8, is used for turning the outside diameter of the crankpin up to the beginning of the fillet, the diameter being left 0.01 in. oversize. Special formed-fillet and broad finishing tools are next used for forming ing the fillet, the machine being run at a very slow speed for this operation. These tools also give the final turning finish to the crankpin, leaving it approximately 0.003 in. oversize for polishing, the same as the journals. The standard requirements are that the axes of both journals and crankpins must be parallel within 0.002 in. in the length of the crankpin. The final tolerance for diameter after polishing is 0.001 in., plus or minus.

Oil holes for the crankpin are drilled with the portable machine shown in Fig. 12. This is simply a small electrically-driven radial drill, mounted on a suitable truck and with adjustment both as to position and angle of the hole to be drilled. A small crankshaft is shown, together with the way in which the drill is mounted, so that it can easily be turned to any desired position and clamped for drilling. Both the supports for the crankshaft and the truck carrying the drill can be moved to accommodate any crankshaft to be drilled. The lever at the end permits the truck to be locked to the track during the drilling operation.

A completed 4-throw crankshaft is shown in Fig. 13, as are the oil holes in both the crankpins and the webs. This view also shows the air stops, which are in the



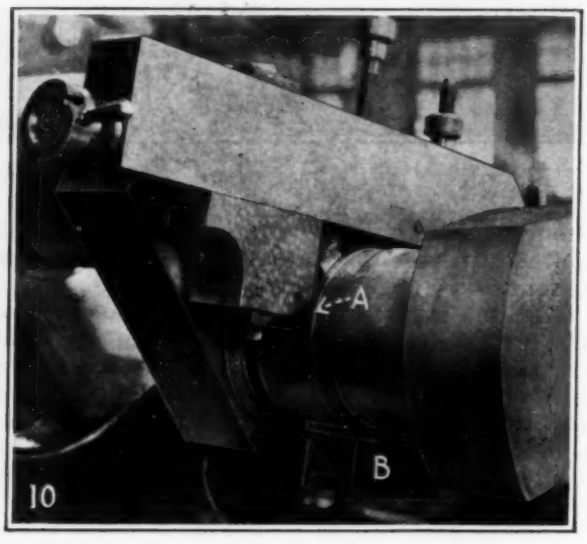
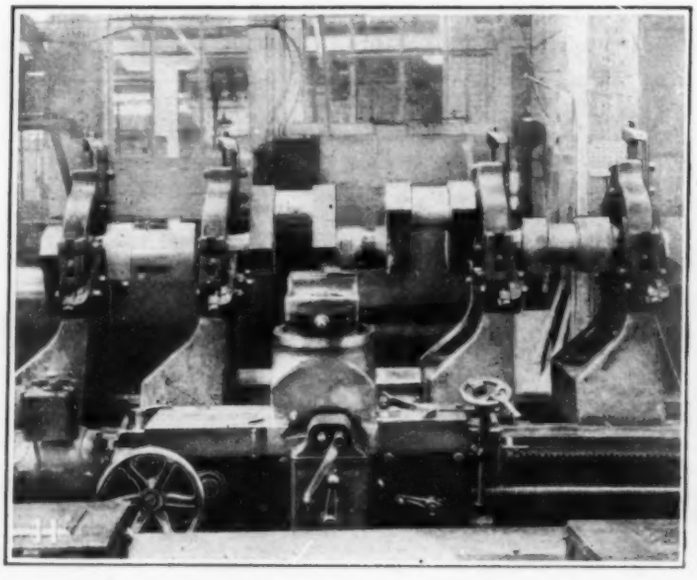


Fig. 9—Spotting bearings for finish turning. *Fig. 10—Details of Webber tool used*



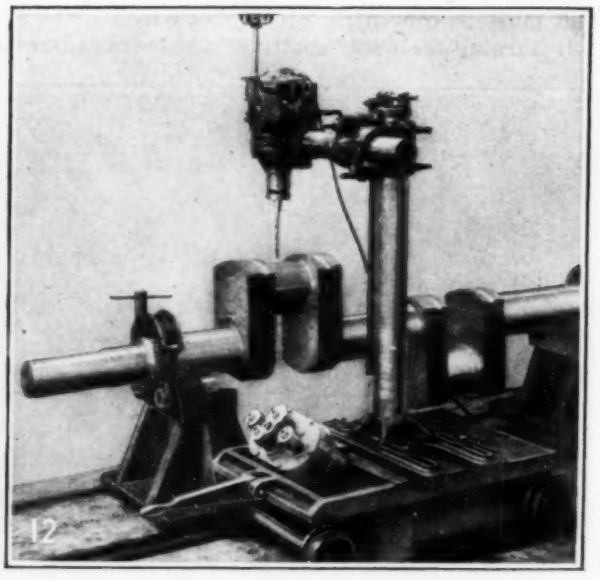


Fig. 11—How four steadyrests are used. *Fig. 12—Drilling the oil holes*

AUTOMOTIVE PRODUCTION

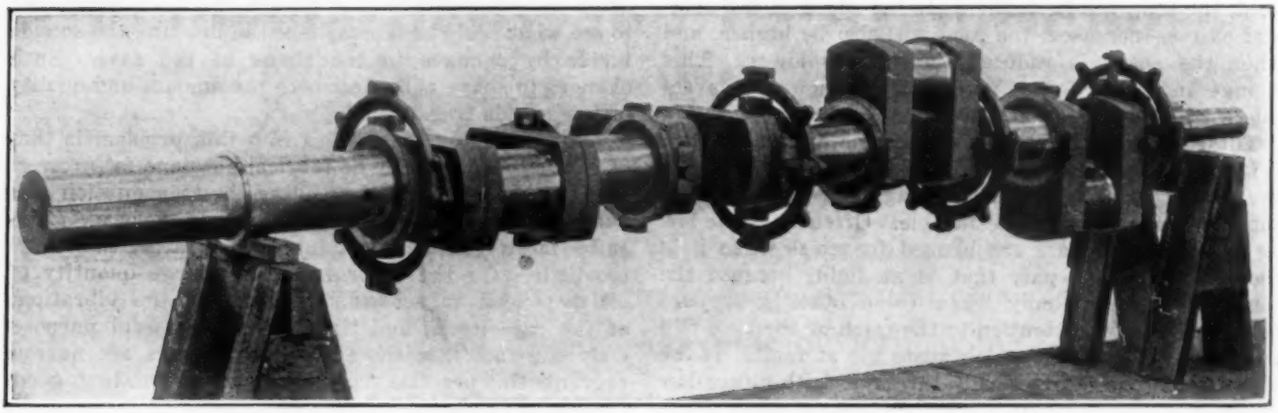


Fig. 13—A completed four-throw crankshaft

form of rings that make a joint to prevent air from passing from one chamber of the crankcase to the next. The methods used result in the production of excellent crankshafts, both as to material and quality of workmanship.

The accuracy required may be summed up as follows:

1—Axes of journals and crankpins to be parallel within total of 0.002 in. measured in the length of the crankpin.

2—Variation in axis of any journal from axis of shaft, measured by revolving the shaft in V-blocks, shall not exceed 0.0015 in. radially, measured in the length of the journal.

3—Axially, center to center of adjacent cranks, plus or minus 0.015 in.; center to center of extreme cranks, plus or minus 0.030 inch.

4—Angular position of centers of crankpins, plus or minus ½ degree.

5—Radially, distance from center of shaft to center of crankpin, plus or minus 0.010 inch.

6—Diameters of pins and journals, plus or minus 0.002 inch.

7—Pins and journals to be within 0.002 in. of round.

8—Journals, pins and fillets all to be highly polished; all other parts to have smooth tool finish except sides and faces of crankwebs, which are to have a tool finish (but not of such roughness that waste fibers will catch on them).

Study of Probable Sources of Noise in Transmissions

By Earle Buckingham

NOISE is relative rather than absolute. Noise may be defined as an unpleasant or objectional sound. This is certainly its definition as applied to transmissions.

A solution of this noise problem that may be satisfactory today will not necessarily be a satisfactory solution next year. Other parts of an automobile have been made quieter than before. As a result, sounds from the transmission which before had been unnoticable, today are objectionable.

Although we shall probably have this problem of noise with us always, it should be worth while to stop and consider the many probable sources. We will first consider the gears. These are notorious offenders, and bear the largest part of the blame.

To reduce the noise of the gears, three courses are open. First, eliminate them. If this does not seem possible, the second step might be to reduce the amount of sound produced by them. A third step would be to change the quality of the sound produced from an unpleasant one to an unnoticeable one if possible.

There is but one method of reducing the amount of sound produced by gears. That is accuracy and smoothness of profile. Design may help some, but this design must be coupled with high class workmanship to secure results. The search has been made for many years, and still continues, for some form of modification of tooth profiles that will obviate the need of accuracy. This search has been fruitless in the past and probably always will be. If such a modified form should be discovered, it will also be found that this modification must be as accurately formed, and the spacing of the teeth must be as nearly perfect, as any other form must be to secure quiet running, while the difficulties of control would probably be far greater.

There are four general characteristic sounds produced by gears. One is an intermittent clicking or irregular growl caused by poor spacing or irregularly formed profiles. Another is a pulsating growl or run-out sound caused by eccentricity. The third is a high pitched squeal caused by rough surfaces. The remedy for all these three is accuracy and better workmanship.

The fourth is a tone which depends upon the pitch and speed of the gears. For example, if a pair of gears are running at such a speed that 435 teeth come in contact every second, a tone corresponding to middle A on the piano will result. If a coarser pitch is substituted, the tone will be lower. If a finer pitch is

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used, the tone will be higher. If the speed of the original pair is increased, the tone will also be higher, and when the speed is reduced the tone is lower. This change in tone is very noticeable when a car is accelerated in low or second gear.

These tones in transmissions become apparent when driving in gear. When clutched in high speed, any gears that are engaged are idling, and seldom make sufficient sound to be objectionable. Oftentimes the low or second speed gears are blamed for noise when it is the constant drive pair that is at fault, because the sound is apparent only when these other gears are engaged. A little attention to the pitch of the tone will soon make it apparent which gears are at fault. If the objectional tone is practically the same with either low or second speed gear engaged, the constant mesh gears are producing the noise. If the objectional tone is lower with the low speed gear, then this gear is at fault.

Ratios that Give Satisfactory Combinations in Gearing

When driving in gear, two pairs are engaged. This gives a double tone which may be harmonious or discordant, depending upon the ratio between the numbers of teeth on the gears on the countershaft. These revolve together, and the number of meshes or tooth-engagements per unit of time depends entirely upon the tooth-numbers of these gears.

The following ratios give pleasing combinations of sound or tones:

5:6 minor third
4:5 major third
2:3 perfect fifth
2:1 octave

By keeping the numbers of teeth of the gears on the countershaft to these ratios, we can avoid certain unpleasant tones. For example, if the constant mesh gear has 30 teeth and the second speed gear has 25 teeth, the combined tone will be a minor third as the ratio is 5:6. If the second speed gear has 24 teeth, the combined tone will be a major third. If the low speed gear has 15 teeth, the combined tone will be an octave, etc. Careful attention to the selection of relative tooth-numbers will prove of much aid toward the production of quiet transmissions.

Yet accuracy in production and care in the design of the gears alone will not insure a quiet transmission. The shafts which carry these gears must be sufficiently rigid to hold them in their proper operating positions, else the benefits of good gears may be entirely lost. In general, transmission design in this particular hangs very close to the trouble point where it has not overstepped it entirely.

Some sound is inevitable where power is transmitted through gears. The amount of this sound may be small, yet the shape and size of the transmission case may be such that there will be much more sound outside of it than originally started from the inside. One of the easiest things to accomplish is to make an effective "loud speaker" out of a transmission case. Here the size and shape of the case plays an important, yet unrecognized part. Large flat surfaces, although the easiest to draw, should be avoided. It would be money well spent to experiment with the shape of the case, after the other features of design had been completed, to see what could be accomplished in muffling the sounds inside by changes in the shape of the case. Such changes in shape will affect both the amount and quality of the sounds transmitted.

Another factor that enters into this problem is that of lubrication. As far as lubrication alone is involved, the conventional method of filling the transmission case with oil gives entirely too much. In general, gears suffer more from too much lubrication rather than from too little. On the other hand, this large quantity of oil may tend to act as soft pedal on the vibrations of the case itself, and thus serve one useful purpose. Only the fact that the faces of the gears are narrow prevents this practice from doing more harm than good. Double or triple the width of the faces of these gears, then the heat generated by forcing this oil out suddenly from between the meshing teeth of the gears will soon raise its temperature to a dangerous degree. Some such troubles are experienced in truck drives where the gear faces are wider. Sufficient space should be left in the case for this excess of oil to get out of the way readily, else in addition to an increased temperature rise, further troublesome noises will be very evident.

All moving parts are potential sources of noise. This would bring the bearings under suspicion. Bearings may be noisy either because of faults of their own, or because of external conditions such as improper mounting or alignment which do not give them a fair chance. In addition, the submerged lubrication with which these bearings must usually run, seldom assists to help them attain their best operation.

In addition to its own sins, a transmission case sometimes confesses the faults of other units, acting as a sounding box for vibrations transmitted into it by the propeller shaft from the rear axle. Gear teeth form a loose connection which is very favorable to the transfer of vibration into sound. This in turn amplified by the transmission case, often produces a result both unpleasant and objectionable.

The foregoing does not pretend to exhaust all of the probable sources of noise in the transmission case. When the noises from these sources have been eliminated, however, we shall probably have both the time and experience available to deal with the others.

Competition in Motorcycles

American motorcycles, although encountering increased foreign competition in late years, have been well received in the world's markets.

Motorcycle exports from the United States during the six-year period, 1913 and 1920 to 1924, have exhibited a pronounced variable trend. The volume of these shipments amounted to 3,983 units in 1913; 37,622 in 1920; 11,001 in 1921; 15,976 in 1922; 22,112 in 1923; and 16,859 in 1924. The high point was thus reached in 1920. Over the five-year period, 1920 to 1924, inclusive, the yearly average of exports was almost 21,000 units. Exports during 1924 scarcely went over four-fifths of this five-year average. Increasing competition from European producers has been the greatest factor in keeping our volume smaller.

Photoelasticity and Its Application to Gear Wheels

By A. L. Kimball, Jr.
Research Laboratory, General Electric Co.

Internal angles and fillets generally points of high local stress—Strains due to improper mounting—Results shown by graphs—A simple impact machine

A VERY beautiful application of the photoelastic method can be made to spur gears, because in this type of gearing the stress lies in a single plane, namely, in the plane of the gear wheel. The stress distribution in models of celluloid will give an accurate representation of that in the corresponding steel gear-wheels.

The tests that have been carried out on gearing may be divided into three parts:

1—Determination of stresses in gear teeth under static load.

2—Verification of photoelastic-method results by mechanical tests.

3—Study of stresses in revolving gear wheels.

Two types of pinions examined under static load are shown in Fig. 8. In order to apply the load, the pinion to be examined was mounted upon a tapered, expansion ring, and the torque applied by the special loading frame shown in Fig. 9, and measured by suitably mounted dynamometers. Fig. 10 shows the system of principal-stress lines as determined by photoelastic observations for design in the upper part of Fig. 8.

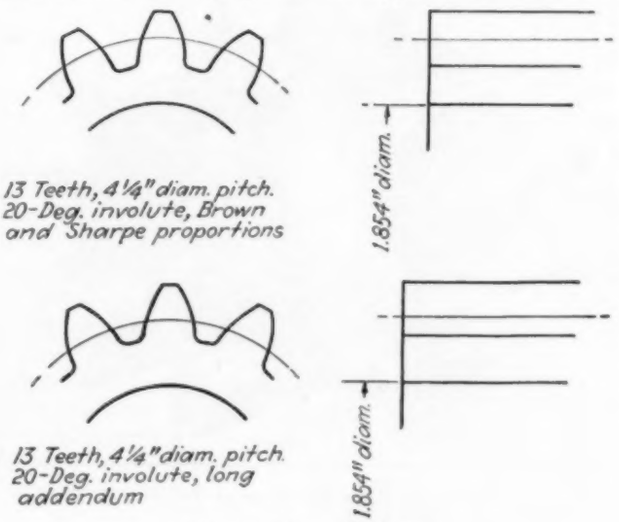

13 Teeth, 4¼" diam. pitch.
20-Deg. involute, Brown and Sharpe proportions
1.854" diam.
13 Teeth, 4¼" diam. pitch.
20-Deg. involute, long addendum
1.854" diam.

Fig. 8—Gear designs

The load was applied at the point shown by the arrow by another exactly similar tooth, not shown in the figure, mounted in the loading frame. Figs. 11, 12 and 13 also show results of observations taken on the same design. Fig. 11 shows the tangential stress along the boundary of the tooth on the tension side. The stress magnitudes at the points 1, 2, 3, etc., are graphically represented by the lengths of the radial ordinates of the curve. Fig. 12 shows the same thing for the compression on the compression side. It will be seen that the maximum compression is somewhat greater than the maximum tension.

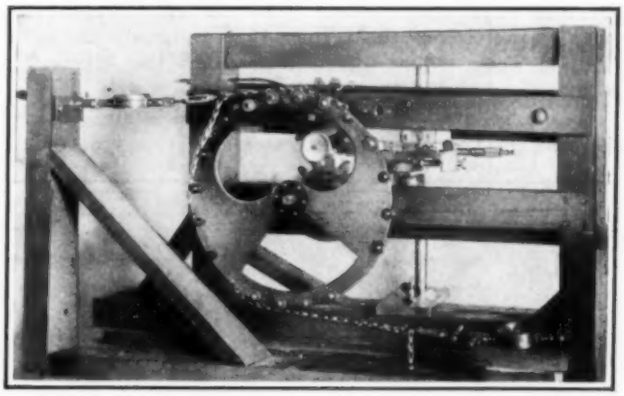


Fig. 9—Loading frame

In both cases the greatest stresses occur in the fillet at the root of the tooth. It is generally borne out by photoelastic observations on many different designs that internal angles and fillets are apt to be points of high local stress, and the sharper the internal angle the greater the stress. The maximum in the cases shown is seen to be some 80,000 lb. per in. The maximum stress found in the celluloid was of the order of 3,000 lb. per in. But the load applied per inch of tooth face was correspondingly smaller, a correction also being made because the model was somewhat larger than the actual pinion. The models were about 6 in. in diameter and of celluloid ¼ in. in thickness. The design in the lower part of Fig. 8 was compared with that in the upper part through maximum-stress measurements only. The results are as follows:

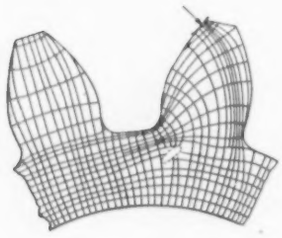
For the upper design, max. stress = 80,000 lb. per inch.

For the lower design max. stress = 70,350 lb. per inch.

These stresses correspond to the highest load to which the pinion would ever be subjected in service, due to tractive effort. They are considerably higher than those

Conclusion of the article.

given by the usual methods of calculation for the same load, but photoelastic measurements show them to be of quite local character and near the surface. The distribution of the stress between the two sides of the pinion is far from linear. Fig. 13 shows exactly how the stress is distributed along the line *AB* through the root of the tooth. Principal stresses are shown both in direction and magnitude by the arrows. The upward-pointing arrows indicate tension and the downward-pointing ones compression. The curves represent the locus of the tips of the arrows that designate the principal stresses. The figure represents the stress for points along the section *AB* only.



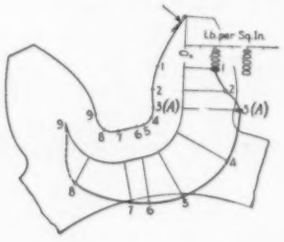


Fig. 10—Principal stress lines in loaded gear tooth.

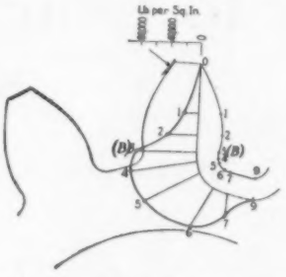


Fig. 11—Boundary stress, tension side.

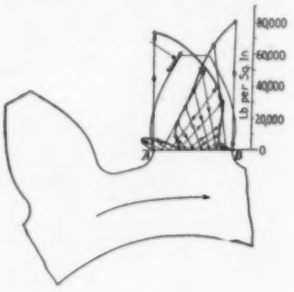


Fig. 12—Boundary stress, compression side.

Fig. 13—Principal stresses for points along the line AB

If one follows along this line with his eye, he will see that the two principal stresses are always perpendicular to each other, and furthermore, by comparing the same section for the principal-stress diagram, Fig. 10, he will see that there is a correspondence in the principal-stress directions along this line in the two figures, as there should be.

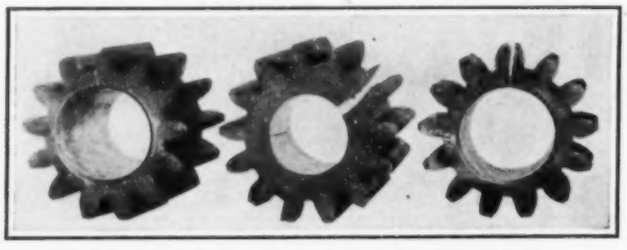


Fig. 14—Pinions ruptured by tapered plug

A very surprising thing shown by the photoelastic measurements, was that on pressing the tapered mandrel into the bore of the celluloid model, contrary to expectation, the stress at the inside boundary of the bore appeared to be greater under the pinion teeth than between them. A remarkable verification of this result was obtained by a mechanical test. Three pinions ruptured by forcing tapered plugs into their bores are shown in Fig. 14. In all cases the ruptures are seen to have started directly under a tooth.

The photoelastic measurements showed little change in the maximum stress under load, as shown in Figs. 11 to 13, as the bore pressure was increased, but the stress tended to concentrate lower down than with small bore-pressures. This is an important point and will be referred to later. A rupture that occurred after long service is shown in Fig. 15 in which evidence of the fatigue action is indicated.

In order to test the strength of pinions against repeated impacts and to supplement the photoelastic tests, the special impact machine shown in Fig. 16 was built.

The 32-lb. weight, *W*, falling through a height of 12 in., delivers repeating blows on one end of the tooth, normal to the tooth profile, through the hardened-steel pin *R*. The weight is raised and released by a rotating arm driven by an electric motor. When the tooth breaks, an electric contact is made by which the circuit is broken. A pinion broken on this machine is shown in Fig 17. It will be seen that the teeth that failed show fractures straight through the roots. Comparing these fractures with those in the case of failure in service, as shown in Fig. 15, a definite difference is at once observed. The fractures in Fig. 15 extend much farther below the roots of the teeth and into the pinion and have a decided V-shape in contrast to the straight fractures obtained in the test case of Fig. 17. It will be recalled at this point, that the photoelastic measurements showed that when the bore pressure was increased through forcing the model onto the mandrel, the zone of maximum stress in loaded teeth dropped farther down toward the root of the tooth than when the bore pressure was small. This suggested that the V-shape of the service failure was due to the heavy bore-pressure, especially as the test fractures of Fig. 17 were obtained with a comparatively light bore-pressure. In order to test this theory, a series of impact tests was made with varying bore-pressures. A well-fitting, tapered plug was forced into the bore of the pinion with different degrees of pressure. Fig. 18 shows fractures obtained on the impact machine for various plug pressures.

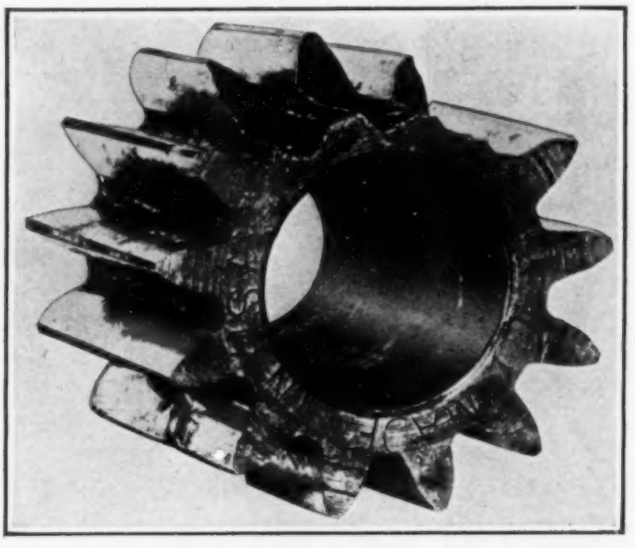


Fig. 15—Pinion that failed through fatigue in service

The tooth marked 1 was broken with comparatively small bore pressure. For cases 2, 3, 4 and 5, the plug pressures used in mounting the pinion were 5,000, 10,000, 25,000 and 40,000 lb. respectively. It will be seen that as the bore pressure was increased, the fractures assumed more and more of a V-shape, which is what would be expected from the photoelastic observations. These test fractures are typical of just the sort of fractures that occur in service. Fig. 19 gives a pair of very interesting curves which show how the fatigue-strengths of pinions, as measured on the impact machine, vary with the plug pressure. The upper curve is for 0.42 per cent carbon-steel pinions that were first normalized by heating to 900 deg. C. (1,650 deg. F.) and oil quenched, followed by reheating to 760 deg. C. (1,400 deg. F.), water quenched and drawn at 200 deg. C. (392 deg. F.). The hardness was 555 Brinell. The lower curve is for a series of pinions made from practically the same steel, but with a simple hardening treatment consisting of water quenching from 810 deg. C. (1,490 deg. F.) and drawing at 200 deg. C. (392 deg. F.). The hardness was 512, as indicated by the Brinell test.

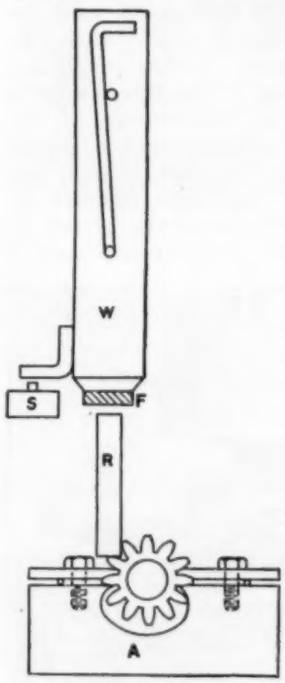


Fig. 16—Impact machine

In the first case, the yield point is at about 40,000-lb. plug pressure. In the second case, it is at about 25,000-lb. plug pressure. In both cases the fatigue strength of the teeth is seen to rise somewhat at the yield point. This may be due to a redistribution of stress, due to plastic yielding, which at first somewhat decreases the maximum stress. Beyond the yield point, irregular results were obtained in both cases. When several teeth were broken from a pinion mounted with a certain initial plug-pressure, the teeth showed successively greater and greater fatigue-resistance. For instance, with a plug pressure of 30,000 lb., the first tooth failed after 1,028 impacts; the second after 2,658; the third after 3,633; and the fourth after 4,383 blows. With the failure of each tooth, the elastic grip of the pinion decreased step-by-step because of the loss of its material with a corresponding decrease of bore pressure and increase of fatigue strength. A lesson to be learned from this part of the investigation is, that fatigue failures are likely to result from too severe mounting pressures. Although the material may be of high grade, metallurgically, this cannot compensate for carelessness in mounting. Furthermore, it should not take a great deal of practice for an operator to judge bore-pressures with considerable accuracy from the character of the failures, and thus locate cases of excessive mounting pressure.

Fig. 17—Pinion that failed through fatigue in test

Fig. 18—Series of teeth that failed through fatigue in test, due to varying pressures

The remainder of the paper will be devoted to another phase of the subject to which particular attention is now being given, namely, stress measurements in gearing while it is actually revolving, thus involving impact.

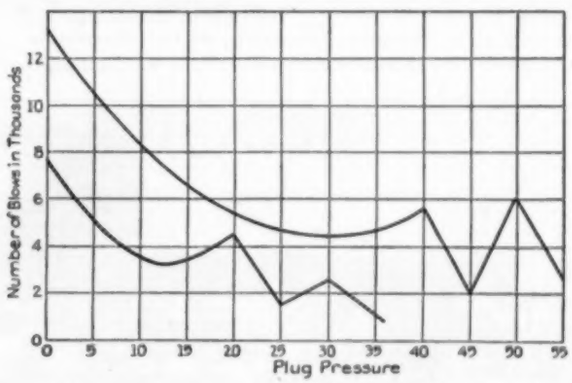


Fig. 19—Curves of fatigue strength, plotted against plug pressure

effects and possibly vibration effects. A preliminary study will be described in some detail, followed by a brief description of the present trend of the investigation. Celluloid pinions are being used as before, except that they are part of a system of revolving gears, and photoelastic observations had to be made while the

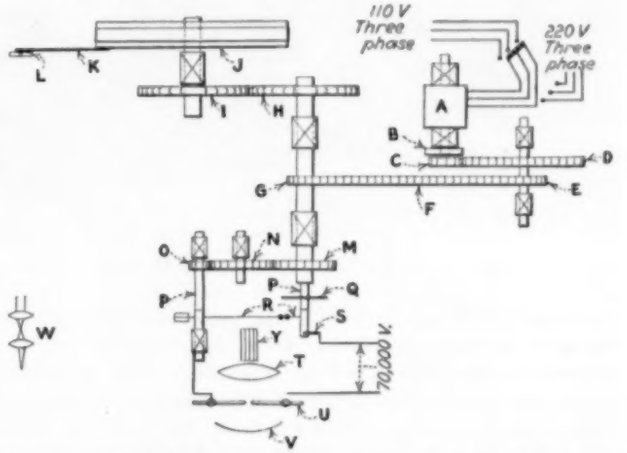


Fig. 20—Diagram of original apparatus used for the measurement of stresses in revolving pinions

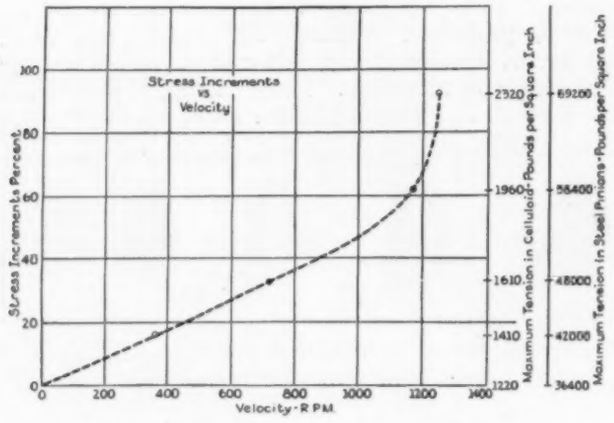


Fig. 21—Curve showing per cent increase of stress during rotation, over that for no rotation

celluloid gears were revolving under load. The real problem to be solved was how to obtain a stationary image suitable for photoelastic analysis, which image would show the stress distribution in the revolving pair of pinions. This was accomplished by the use of a repeating electric-spark, occurring at the successive instants when the stress distribution in a particular tooth gives the per cent increase of stress obtained during rotation tests, over that obtained during the corresponding static tests. A decided rise in stress occurs at about 1,200 r.p.m., suggesting a point of vibration resonance. The speed could not be carried higher in this test, because of limitations imposed by the apparatus.

Simplified Apparatus for the Study of Stresses in Gears Under Load

The study is now being made with a greatly simplified apparatus, a photograph of which is shown in Fig. 22. This apparatus has an exact symmetry as regards driving and driven members, and the rotating parts are reduced to simply two, one driving and one driven. The rotational movements of inertia and the elasticities of the shaft of the driving and the driven members are the same. The driving motor is exactly the same as the generator that absorbs the power at the other end. The reason for this simplification is, that both the writer and Prof. Paul Heymans, of the Massachusetts Institute of Technology (who is collaborating in this investigation), firmly believe that rotational oscillations of the component parts of the revolving system may play an important part in the maximum stresses developed. The study of as simple a revolving system as possible is, therefore, the first step, because such a

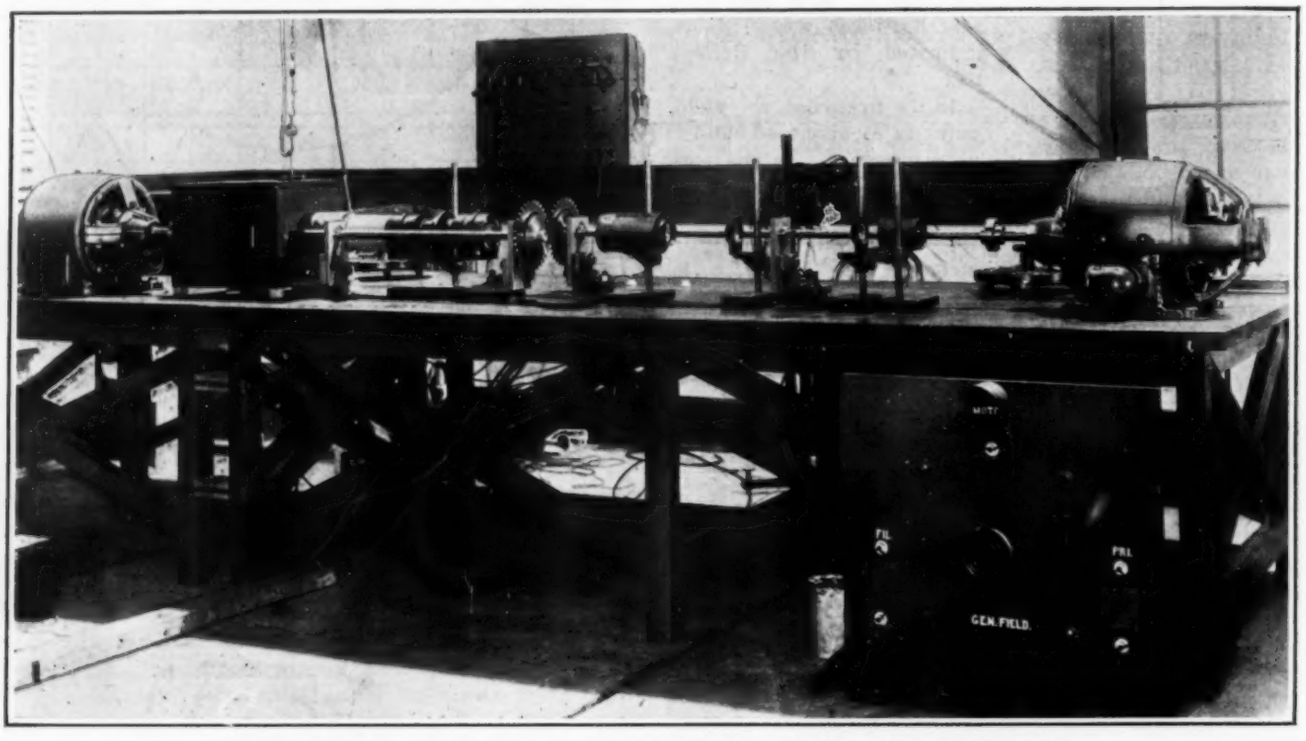


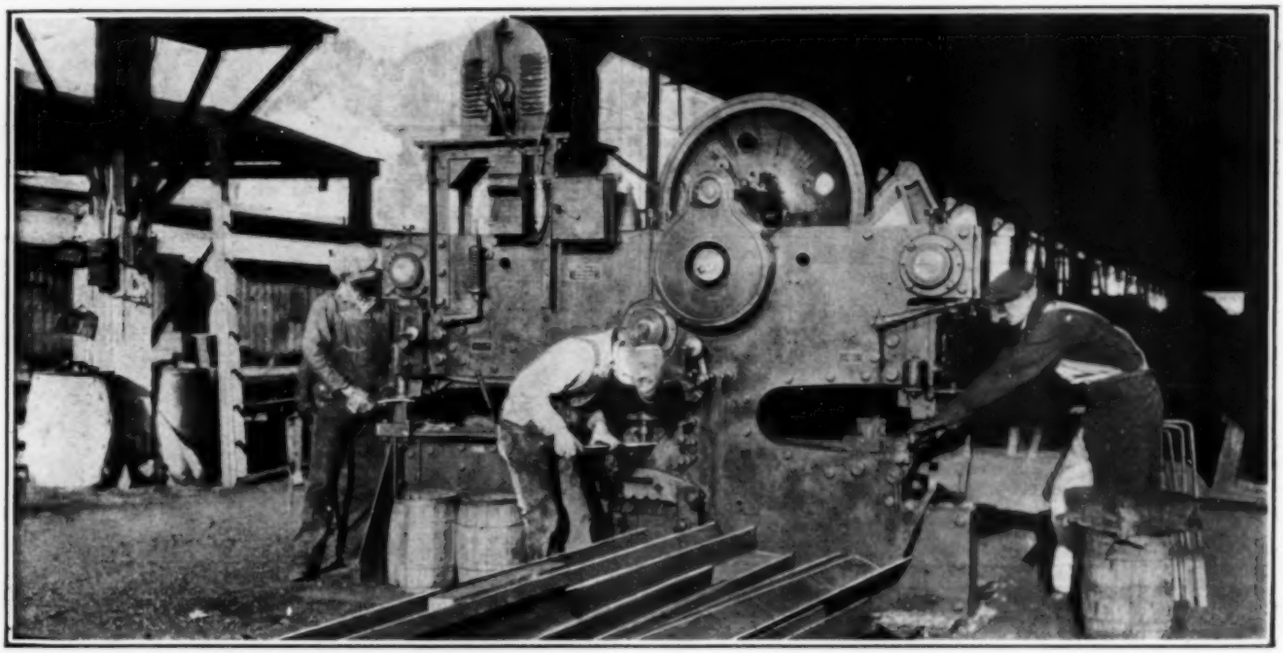
Fig. 22—Photograph of new set for photoelastic test of revolving gear wheels

repeated itself, as the stress went through its cycle of changes during each revolution. A diagram of the apparatus used is shown in Fig. 20. The recurring spark takes place at the gap *U* and projects a beam of light through the condensing lens *T*, through the celluloid gears *H* and *I*, and is observed directly by the eye, or is projected upon a screen, or upon a photographic plate for analysis. The spark timing is controlled by the gears *M*, *N* and *O* and the revolving knobs *R*, which are in the high tension circuit and pass close together at the instant the spark is required.

The results of this test are shown in Fig. 21, which system is most likely to yield useful results that can be explained quantitatively.

Acknowledgement by the Author—The photoelastic studies outlined in this paper were made by the author and Prof. Paul Heymans and T. H. Frost, of the Massachusetts Institute of Technology, at Cambridge, using the apparatus of the General Electric Company.

The mechanical tests were carried through by G. R. Brophy at the General Electric Research Laboratory, at Schenectady, except for the three pinions ruptured by plugs, which test was made by Professor Heymans at Cambridge.



Little Rock Shop Methods

By Howard Campbell

Standard mechanical equipment augmented by labor saving devices—Milling and grinding operations—A quick-acting clamp —Turning tumbling-shaft bearings—Bench and floor fixtures

WHILE the Missouri Pacific Railway shops at Little Rock, Ark., are not new, sufficient equipment of modern design has been added from time to time to enable first-class work to be turned out at costs that will compare favorably with costs on similar operations in other shops. In addition to this, a number of time- and labor-saving tools and devices have been devised.

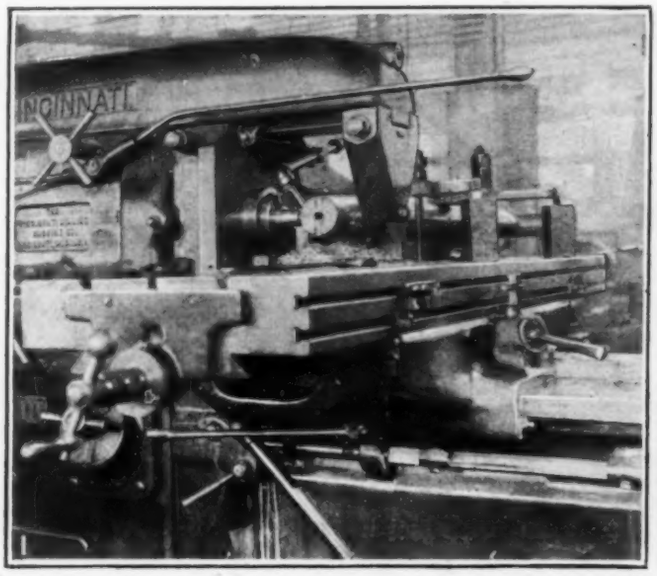
The illustration at the head of this article shows a Pels punch and shear upon which three men can work simultaneously, performing three different operations. At the time the picture was taken one man was cutting off keys for brake ratchets, the man in the center was cutting off a section of angle iron, and the third operator was punching holes in a strip of metal. The machine is used for cutting and punching sill steps and similar parts for all classes of cars. The same operations can be performed as on any other kind of shear. The center shear is especially designed for shearing angle iron, round and square bars, I-beams, rivets, bolts, and so on.

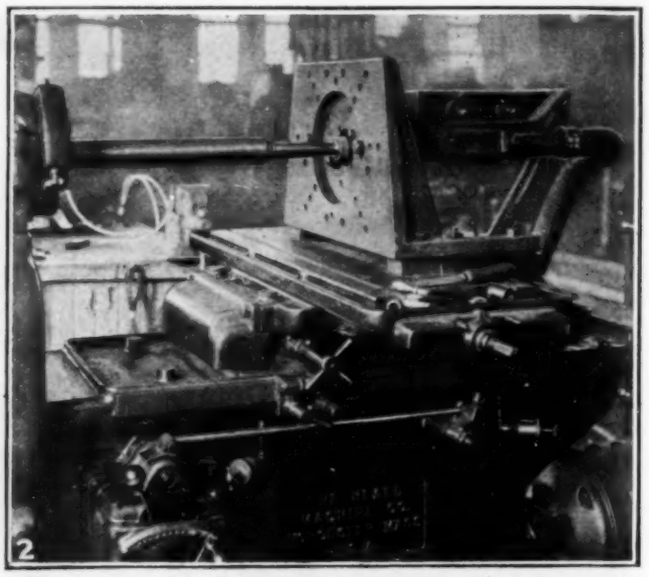
The No. 5 Cincinnati milling machine shown in Fig. 1, is set up to mill the key slot in a piston rod. The slot is laid out and a $\frac{7}{8}$-in. hole is drilled at the end of the layout. Then the rod is clamped in V-blocks on the table of the machine and a $\frac{3}{4}$-in. helical cutter is inserted through the hole, as shown. The cutter is run at 288 r.p.m., while the table feeds 1 in. per min., coolant being used. The job can be completed by this method in 30 min. This machine is also used to block out the ends of side and main rods, machine heavy strap brasses, motion work, shoes and wedges, truck boxes for the pedestal fits, and so on. A good milling machine will effect enough of a saving in any medium-sized shop to pay for itself in a few months, besides producing better work than can be produced by any of the older methods.

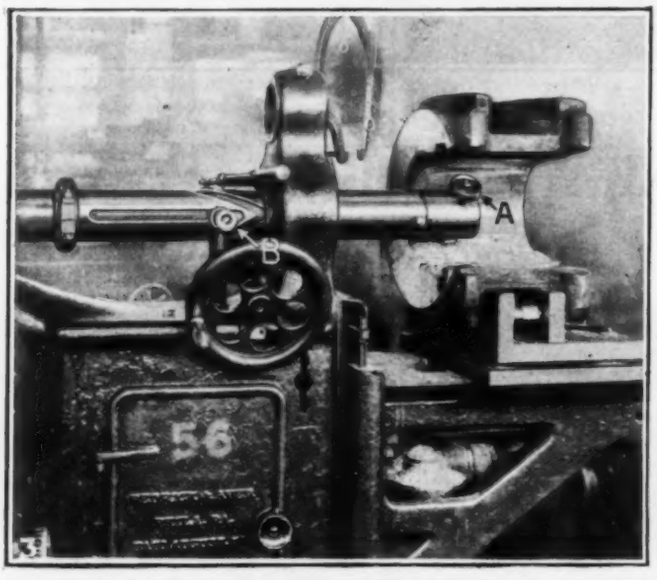
Another machine that is gradually coming into its own in the railroad shops is the grinding machine, both for external and internal work. The finish that can be obtained on running parts and the ease with which a few thousandths of an inch can be removed, are factors that cannot be overlooked in the selection of machine shop equipment.

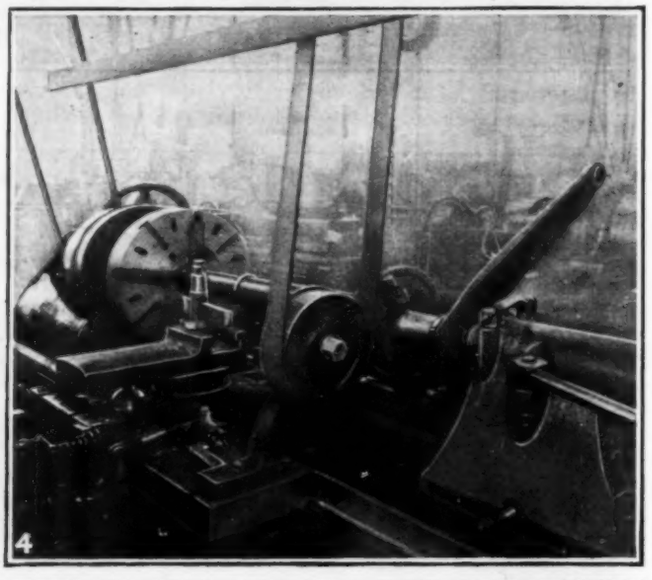
A fire-door cylinder set up on a Heald internal grinding machine to have the bore ground true, is shown in Fig. 2. The cylinder is held on a special fixture and approximately 0.004 in. of stock is taken out, which is just enough to true up the hole. The grinding wheel runs at 4,500 r.p.m. while the cycles of the planetary motion are 45 per min. The feed is 10 in. per min. Approximately 0.001 in. is taken out at a pass and the whole job is completed in 45 min., including the set-up.

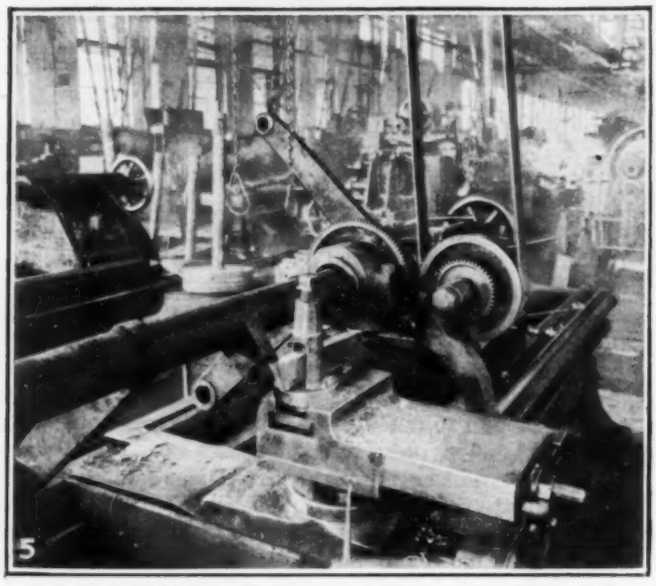
The operation of milling oil grooves in driving boxes on a Pedrick & Ayer horizontal mill is shown in Fig. 3. The horizontal sleeve carries a shaft geared to the cutter-spindle and driven by a belt and pulley at the rear end of the machine. The cutter-spindle is carried











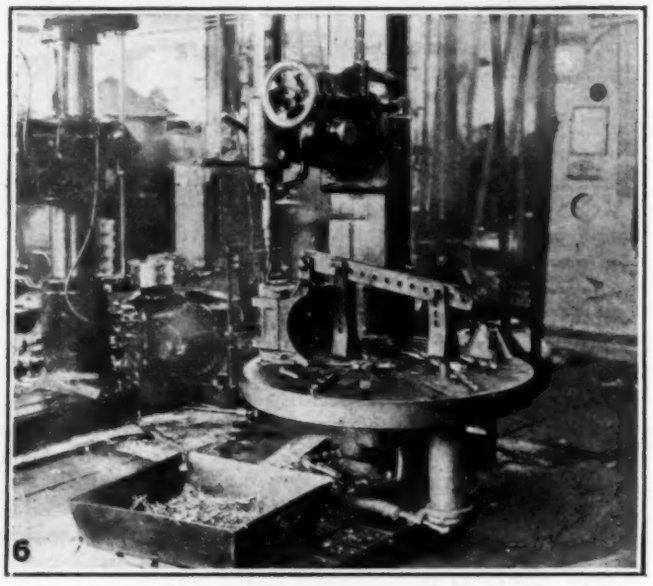


Fig. 1—Milling key slots in piston rod. Fig. 2—Grinding bore in fire-door cylinder. Fig. 3—Milling oil-grooves in driving boxes. Fig. 4—Turning tumbling-shaft bearings. Fig. 5—Rear view of gearing Fig. 6—Pneumatic clamp attached to drill-press table

in a section attached to the end of the sleeve, and is controlled by a screw operated by the knurled knob *A*, so that grooves of any desired depth can be milled. There are one straight and two angular grooves in the sleeve into which the spring-pin *B* fits, thus providing means for guiding the direction of the cutter. The

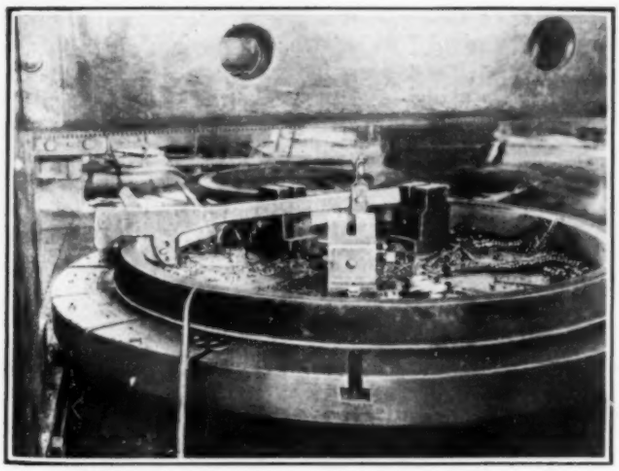


Fig. 7—Tire-handling device

cutter is a ¾-in. end-mill and runs at 800 r.p.m. It is fed in at one end of the intended groove to a depth of ¾ in. and the groove is then milled to the desired length, the cutter following the direction determined by the groove in the sleeve in which the pin *B* is located. The grooves in a driving box can be completed in 12 min. with this machine.

Tumbling-shaft bearings are turned in the Niles lathe, Figs. 4 and 5, in which a special fixture has been attached to the carriage, as shown. The fixture carries three gears and a pulley, power being supplied from a long countershaft over the machine so that the belt will travel with the carriage as it moves back and forth. The pulley is integral with a gear that drives the large gear to which the tool is attached, through an intermediate gear, as shown in Fig. 4. The large gear is made

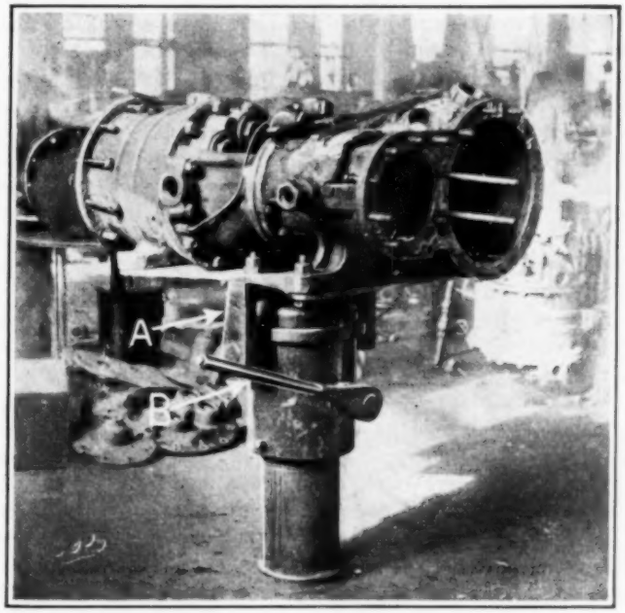


Fig. 8—Device for holding air-pump cylinder

in halves so that it can be placed over the shaft and bolted together. The hub of the gear runs in a bearing in the bracket as shown in Fig. 5. The shaft is carried between the lathe centers and is held stationary while the tool is in operation. The gear that carries the tool revolves at 51 r.p.m. and a fine feed is used.

A simple but very efficient pneumatic clamp is shown in Fig. 6, attached to a drill press table in such a manner that the work can be instantly clamped or released by opening or closing a cock in the air-line. The cylinder, which can be seen attached to the under side of the machine table, is made of a 12-in. section of 4-in. pipe. The piston rod is 1¼ in. in diameter, having a head made of ½-in. plate with a disk of harness leather cupped over it. A threaded extension on the upper cylinder head is inserted through a hole in the table, where it is held by a nut. When the cock is opened, the air forces the piston up, raising that end of the bar to which it is attached. The opposite end of the bar lowers, and a flat steel pad having a corrugated surface and attached to the end of the bar, holds the work firmly in place. Extra holes in the bar, in the clevis by which it is attached to the piston rod and in the support that serves as a fulcrum for the bar, provide adjustment for work varying in height, within

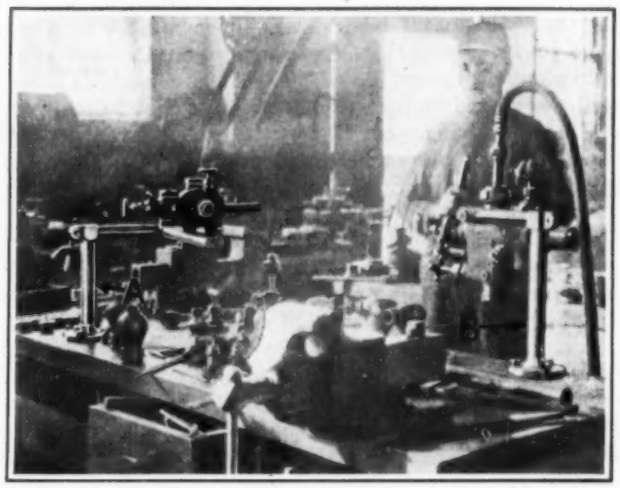


Fig. 9—Bench stands for awkward parts

certain limits. Similar clamps are used on all the larger machines and save a considerable amount of time and labor.

A device for handling tires to and from the boring mill is shown in Fig. 7. It consists of a bar in the head of which is an opening large enough to admit the tire tread and to carry an eccentric jaw, as shown, the opposite end of the bar being attached to the chain by which it is lifted. An adjustable clamp, carrying a link, provides means for shifting the position of the suspension point to obtain the proper balance. The eccentric jaw is held by a pin that can be inserted through either of three holes, thus varying the opening according to the thickness of the tire. The clamp can be instantly dropped onto a tire and as quickly removed when the tire has been deposited, thus eliminating the use of hooks.

A device for holding air pumps while they are undergoing repairs is shown in Fig. 8. The pump is bolted to the table as shown, the table being supported by two arms *A*, one at each side. The arms are attached to a shaft that serves as the axis of a large worm gear,

meshing with a worm on the shaft operated by the ratchet lever *B*. By operating the ratchet, the pump can be set at any angle most convenient for the workman, from horizontal to vertical.

Special stands, shown in Fig. 9, have been made for holding parts that are awkward to hold in a bench vise. Each stand consists of a vertical column having a flange at the base for attaching to the bench, and is provided with horizontal arms for holding the work in the desired position. The stand *A* is used in repairing lubricators, the lubricator being attached to the arm by the same stud that holds it in place on the engine. The stand *B* is holding an injector, a stud in the horizontal arm being inserted through the hole by which the injector is attached to the engine. The work can be clamped in any position in either a horizontal or a vertical plane.

Essentials of the Modern Drill Jig

By S. W. Brown

THE manufacture of drill jigs has advanced to such a stage of development that, in order to build a jig that will fulfill modern requirements, it is necessary to incorporate in their design and construction a number of modern essentials. These essentials are so well recognized in present-day practice that to omit any of them might subject the jig to criticism or perhaps condemnation. The most important necessities are stability, lightness, durability, rapidity, infallibility, cleanliness, economy, safety and accuracy.

Stability. A drill jig should be stable enough to withstand the strains or stresses occasioned by drill pressure, the clamping of the work and the rough usage to which it is sometimes subjected. Stability should be accomplished by a well-proportioned design of the body-casting of the jig. By suitably ribbing the casting it can be made stable without excess weight.

Lightness. A drill jig should be made as light as possible, consistant with the required stability. Unless the jig is large, it should be light enough to "float" on the drilling-machine table while in operation. In any case a light jig is easier to handle and operate than a heavy one.

Use of Proper Materials to Insure Long Wear

Durability. A drill jig should be constructed to withstand hard usage that it generally receives. The body of the jig should be made of cast iron, unless the jig is small, in which case machinery steel is best suited. The bushings should be of tool steel, hardened and ground, and the clamps, locating blocks, screws and dowels of case-hardened machinery steel. Covers and leaves may be of cast iron or machinery steel, left soft, and should be provided with a good fit in the body. The hinge pin should be well proportioned and made of drill rod, left soft, or tool steel, hardened and ground. Locating blocks should be assembled with screws and good-fitting dowels.

Rapidity. It is important that a drill jig be rapid in operation. If possible, it should be designed to be operated entirely by hand, as the use of wrenches and screwdrivers often cause lost time. The locating and clamping devices should operate quickly, and the screws of the last mentioned should be provided with suitable handles or knobs, making the jig self-contained.

Infallibility. If a drill jig is not infallible it is practically worthless. As operators of jigs are not mechanics, the jig should be made "fool-proof," so that there is no possibility of the work being incorrectly located. Fortunately, it is not usually difficult to make a jig "fool-proof," as this can be accomplished by placing one or more pins in the jig that will prevent incorrect locating of the work. Occasionally a jig is not infallible because of its failure to locate the work properly against the fixed stops, this being caused by improper design or construction. Faulty clamping is a cause of fallibility. If the work to be clamped is thin or weak, it should be suitably supported directly under the clamp.

Cleanliness. All drill jigs should be made easy to clean, especially a large one that should be provided with one or more openings, cast in the body, to allow the chips to be brushed out without turning the jig over. The feet or base should have little bearing surface, as dirt and chips are apt to cause an incorrect rest. Work seats and location stops should be accessible for cleaning and locating surfaces, upon which the work rests, should be as small as consistent with the accurate location of the work to facilitate cleaning.

Economy. An economical jig does not necessarily mean a cheap one, but true economy in jig making is simplicity in design, constructing it with as little machining as possible, and by using standard material, such as cold-rolled steel, drill rod, and commercial screws and nuts, wherever possible.

Use of the Proper Jig

Safety. Operators of drill jigs frequently are injured by the drill catching in the work and whirling the jig around on the table. As this accident happens quickly, the operator usually receives an injury on both hands before he can withdraw them. Accidents of this nature are often the fault of the jig, as a small or medium size jig without a suitable handle is unsafe, especially if it contains large bushings. Sharp corners on drill jigs are unsafe and dangerous and it is the duty of the toolmaker to round all corners that are apt to scratch or otherwise injure the operator.

Accuracy. Where limits of tolerance are established for the location of bushings, it would be well to give this end of jig making a little study, as it is difficult for a toolmaker to work within a limit of 0.0005 in. while a limit of 0.002 in. is generally sufficient and easily maintained. It is therefore obvious that such accuracy is a waste of time. The general workmanship of a jig should be good enough for the purpose it is to serve and not overdone.

Conclusion. There are many other qualities, other than the foregoing essentials, that must be considered in designing a drill jig, but generally no rules can be laid down for them as each jig that is designed for a piece of work is, in a certain sense, an invention, or an adaptation of well-known principles. Hence the clamping and locating devices suitable for a given unit probably would not be adapted to the peculiarities of another part. The nine essentials, briefly outlined, are desirable and usually necessary in all drill jigs, excepting inexpensive and temporary jigs that are made for a few parts.

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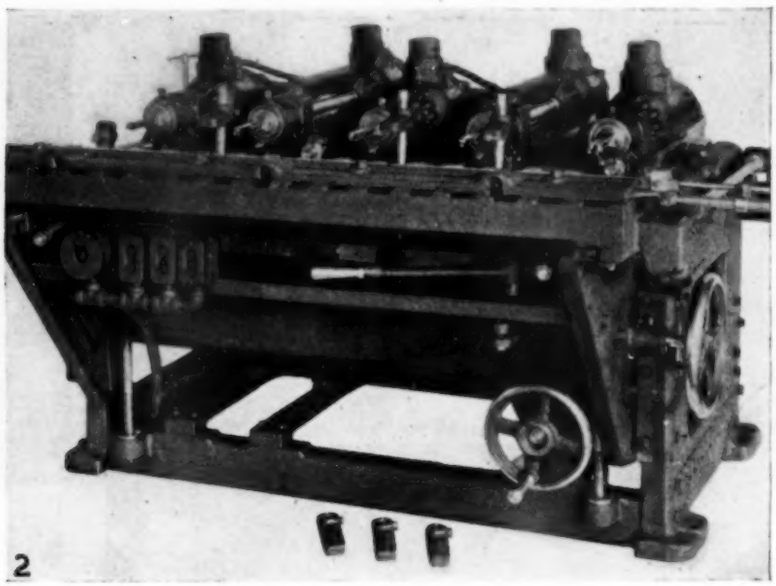


2

Motorized Machines in Many Industries

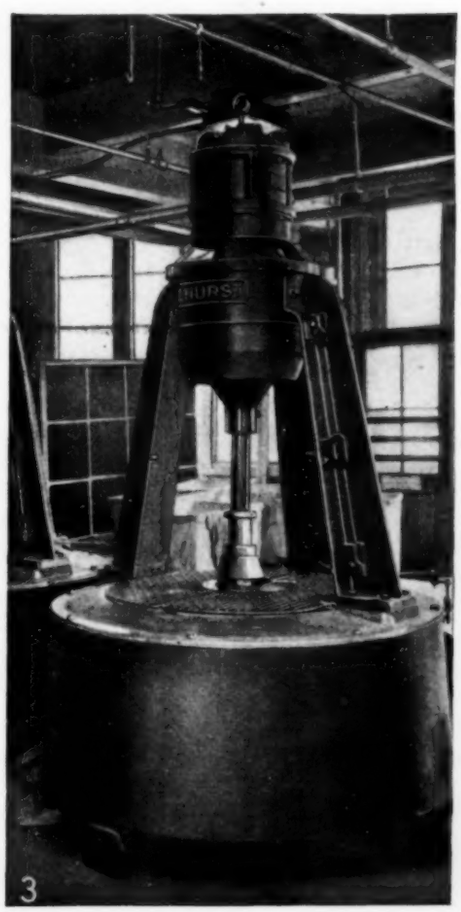
1—Special, inclosed motor with 90 ft.-lb. starting torque on Coffin gate valve

2—Built-in motors on Greenlee mortiser. A sixth motor is used for driving feed

3—Tolhurst centrifugal dryer for laundry use—7½-hp. motor

4—Bottle washer at the Cliquot plant—2-hp. motor

Photographs by courtesy of the General Electric Co.



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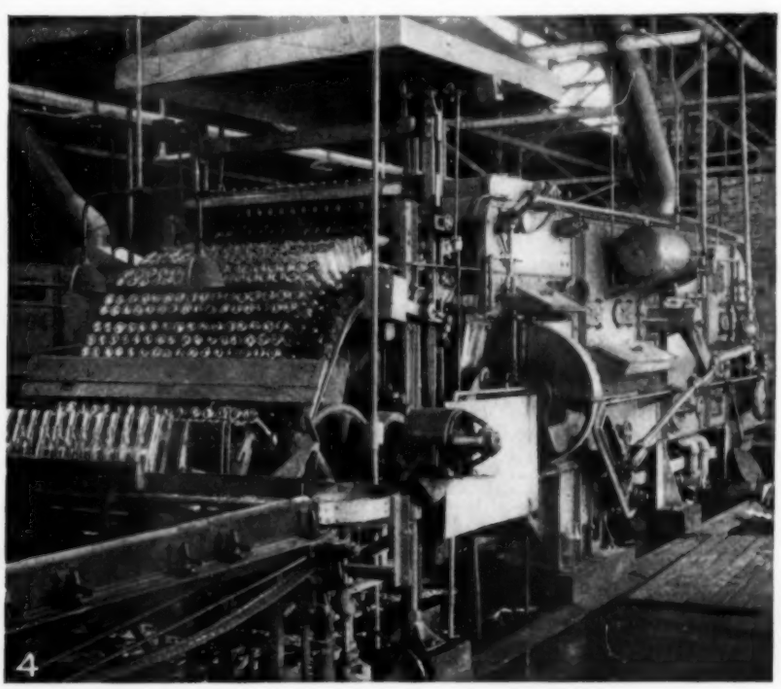

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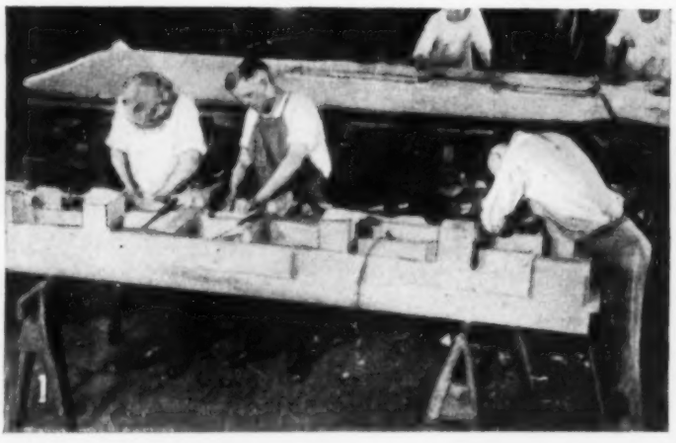
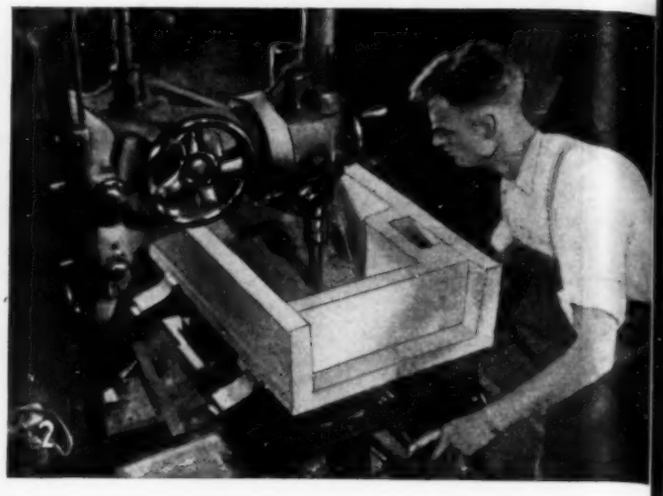




Snap Shots in Steel Railway

1—Making large coreboxes

2—Another corebox job

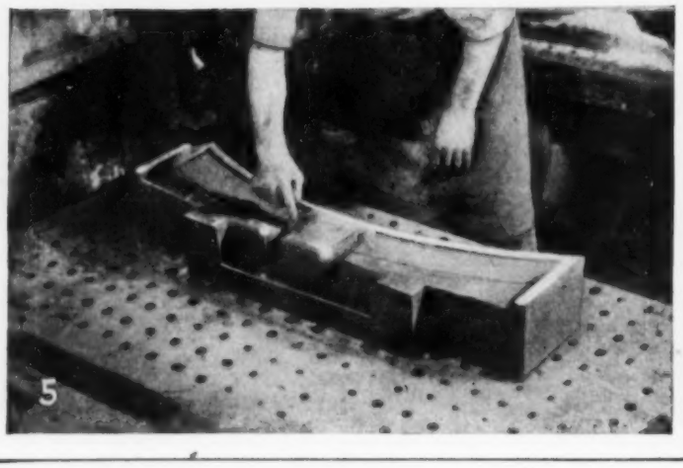
3—Lifting off the corebox

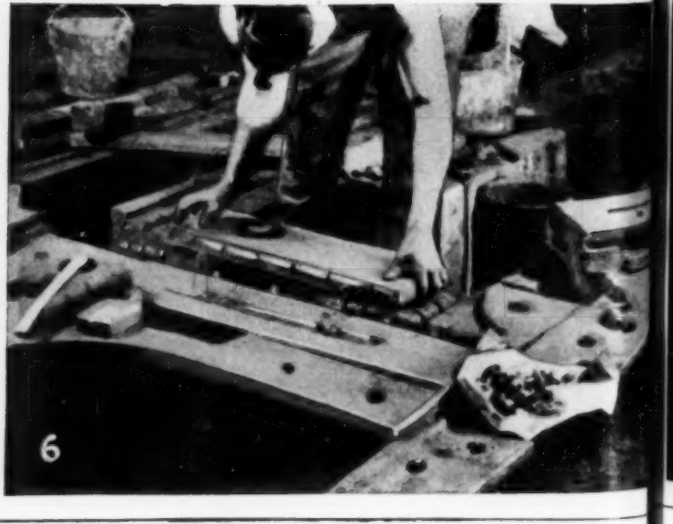
4—Corebox and core

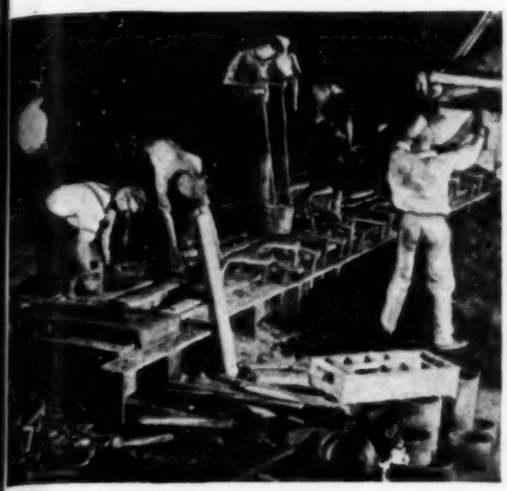
5—Close-up of core

6—Setting a core

Photographs by courtesy of the







the Making of Equipment

7—Corner of small casting floor

8—Car-end of cast steel

9—After the molds have been poured

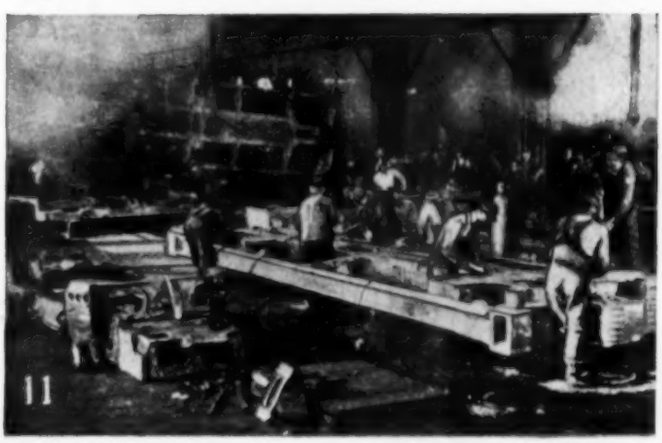
10—Where the metal is melted

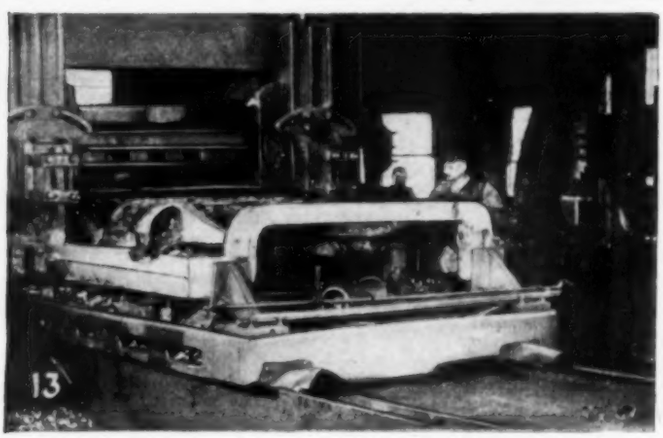
11—Cleaning a large under-frame casting

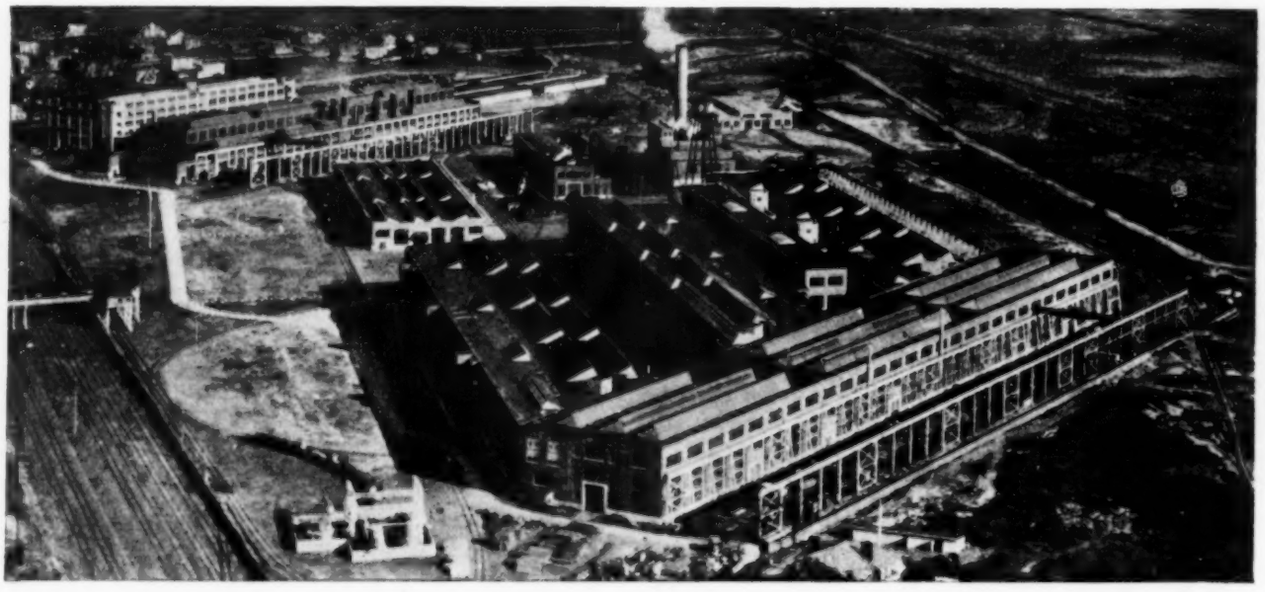
12—Planing the under-frame

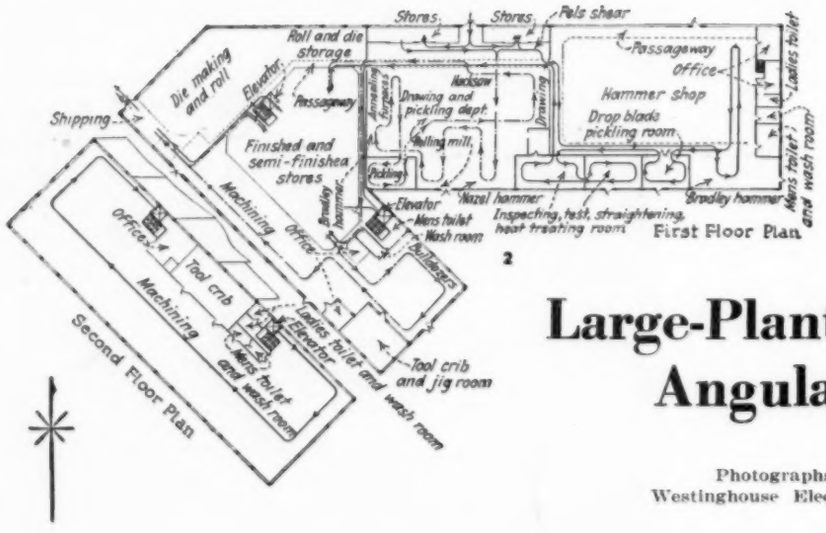
13—Another large planing job

Commonwealth Steel Co., St. Louis, Mo.









2

1—Airplane view of plant

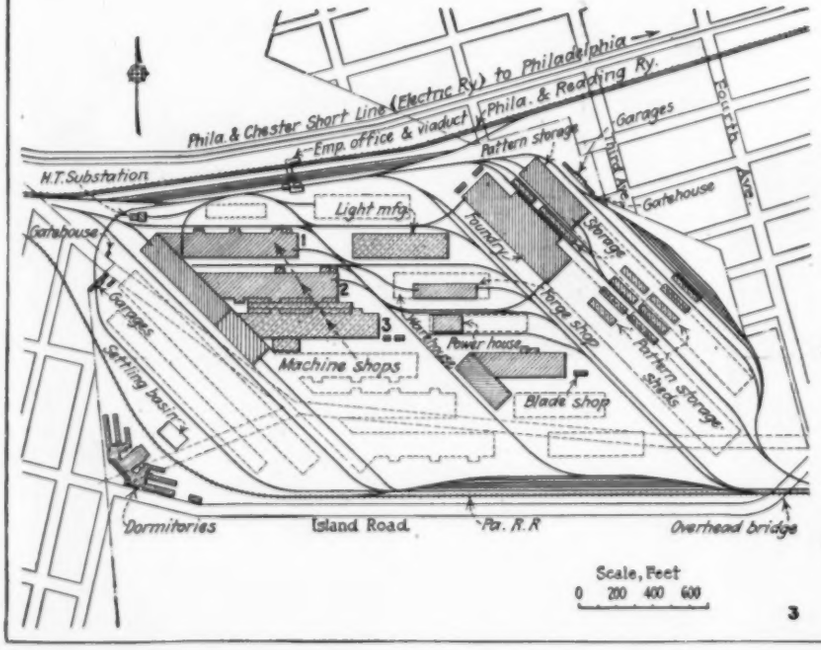
2—Flow chart of blade shop

3—General layout of plant

4—Cross sections at various points

Large-Plant Layout With Angular Feeders

Photographs by courtesy of the Westinghouse Electric & Manufacturing Co.



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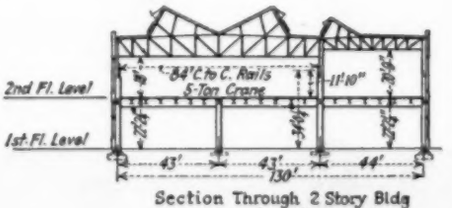
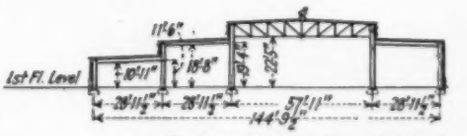
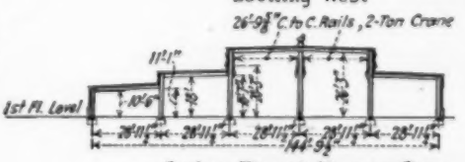


Section Through 2 Story Bldg Looking Northwest

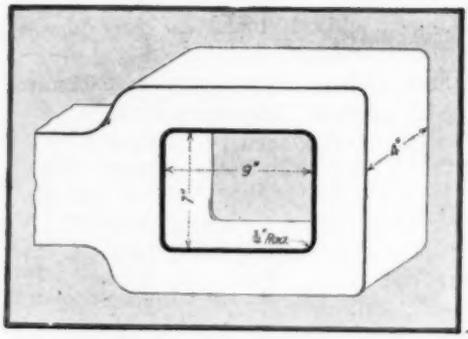


Section Through Draw Die Dept Looking West



Section Through Hammer Shop Looking West

4



To remove the metal bounded by heavy lines in the accompanying sketch in the most economical manner

MATERIAL: 0.50 carbon steel
DIMENSIONS: as per sketch
LIMITS: ± 1/64 in. on all dimensions
QUANTITY: 100 per year in lots of one to four at a time

Note—The job as specified must be completely finished so that no after operations are necessary.

EQUIPMENT: Contestants may select the machine tools and other equipment they would like to use. Complete details of cutting tools must be given.
TIMES: Complete estimates of times of setting up machines and working time, floor to floor, as well as feeds and speeds are to be given.

The first prize problem, for which the winning solutions are given below

Summary of the Solutions to the First Practical Shop Problem

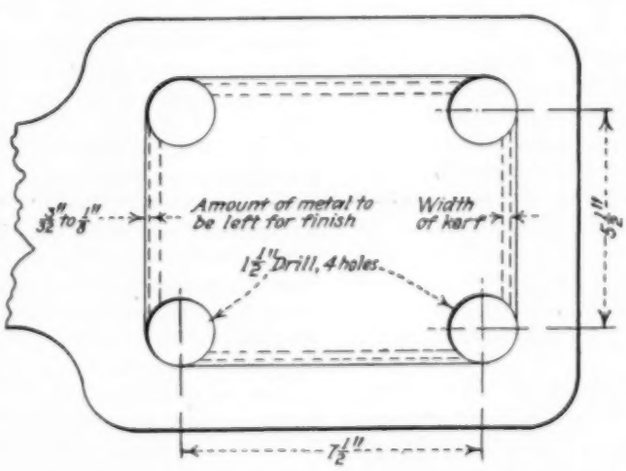
How the winning solutions were selected

THE prize competition offered for the best solution of machining a 7x9-in. hole through a 4-in. piece of 0.50 carbon steel, illustrated on page 328, Vol. 62 of the *American Machinist*, has shown, by the large number of answers received, that our readers have taken an interest in such a contest. Various methods of performing the work were submitted which tend to show the procedures that are followed in different sections of the country.

The time estimates varied from 27 min. to 9 hr., but the majority of solutions ran from 100 to 200 min. The times of the winning solutions were 125 and 150 min., and the methods selected were somewhat similar in sequence. A large portion of the contestants selected drilling, burning out the center with the gas torch and finishing by either slotting or milling. Some of the solutions were exceptionally good, as far as method was concerned, but were disqualified due to an improper time allowance. A number of the answers submitted were not considered practical as only one cut was allowed for finishing the hole after it had been burned out, and the finish that would be produced in this manner could not be called a commercial finish nor would it be possible to hold the necessary limits and maintain a smooth surface.

Some of the solutions called for the drilling of a starting hole, approximately 1 7/16 in., followed by setting the work on a milling machine, using a helical mill 1 1/4 in. in diameter supported by an outboard bearing, and feeding it so that the cutter would remove all the material. This form of cut is not considered quite as rapid as the torch-cutting method.

The drilling practice varied considerably. In some cases the center was removed by drilling a series of holes around the desired contour. The size of the holes varied from a large number of 3/8-in. holes to a few 1 1/2-in. holes, also alternate sized holes using a drill for the corners that was of correct radius for the finish and joining these with a series of 3/4-in. holes. Experience has shown that to remove the center of an opening by a number of holes is difficult, first because the drills run out and leave a thin section of material that can be removed only by some additional operation and second, that a drill which runs into a previously drilled hole is generally broken unless stopped in time. The difficulty mentioned last would increase the tool cost considerably. Because of these facts, it was considered best to burn out the centers. The best solutions followed the method as shown in the illustration. The lay-out was made so that by drilling four 1 1/2-in. holes in the corners, the 3/4-in. radius was produced without further machining. Others drilled only one hole for starting the torch and depended on a tool for finishing the radius. Both methods are good but that mentioned first is to be preferred.



Layout most commonly used

A few of the answers considered broaching as a means of final cut. Since the cost of a broach runs into a large amount of money, the method was not considered good practice, as the total number of pieces to be machined was only 100. While any machine tool or equipment that was favored could be selected, it was up to the contestant to be as economical as possible, yet produce good results. A hole of this size and kind can be successfully broached, but in order to pay for a broach, such

as would be required, the production should be much higher than 100 pieces.

The cutting out of the center by gas torch was greatly favored. Various speeds and time allowances were offered, the average being 12 to 35 min. Considering recent tests that have been made for determining speeds, it is safe to say that the center can be removed in five minutes actual cutting time. The amount of stock to be left for the finish should be from $\frac{3}{32}$ to $\frac{1}{8}$ in., or slightly more. The effect of the heat from gas cutting on metals, similar in carbon content to the one in the problem, has shown that if $\frac{1}{16}$ in. or more is left for finishing, the structure of the material at the edge of the cut will be the same as that of the solid metal. There is a possibility of having hard spots in the hole after cutting out, especially if the work is subjected to cool air, therefore, an allowance of $\frac{1}{8}$ in. is more practical so that the cutter will have a chance to get under the scale in the rough cut and still leave enough metal for a finish cut. The burning of a starting hole through the solid piece was selected by some but there is danger of burning the tip of the torch and moreover danger of leaving a bell-mouthed hole that would not clean up in machining, so this method was not considered the best. Very few made any allowance for the work to be cooled after cutting.

One of the solutions submitted would have received a prize except that the finishing time estimated, after the torch operation, was not subdivided into the necessary rough and finish cuts. The time allowance was fair but no mention was made as to the number of cuts, so for this reason the solution was disqualified. Some of the contestants that made elaborate drawings and illustrated their methods were not considered winners as the time allowance shown was high, or some impossible feat was called for. Some of the other answers will be published later.

Prize Winning Solutions

The best solutions were offered by K. H. Crumrine, Cincinnati Shaper Co., Cincinnati, Ohio, and D. W. Wright, Tool Engineer, Saco-Lowell Shops, Lowell, Mass. The solution of the first mentioned read as follows:

Operation 1—Drill four corner holes.

Note—For making 100 parts per year, a suitable plate jig for drilling full-sized holes for the four corners and laying out the four sides should be provided. This would be a combination jig suitable for performing both these operations, costing approximately $30.

A—Set up first piece and apply jig,	20 min.
B—Drill four 1½-in. holes using full-sized drill with a specially ground point, eliminating the need of a leader drill. Use 127 r.p.m. and 0.010-in. feed,	15 min.
Set up for drilling subsequent pieces, each	5 min.
Drilling time for subsequent pieces, each	15 min.

Operation 2—Cut from hole to hole with gas torch leaving ⅛-in. metal all around for finishing.

A—Preparation for doing first piece,	60 min.
B—Cutting,	30 min.
Set up for cutting subsequent pieces, each	10 min.
Cutting time subsequent pieces, each	30 min.

Operation 3—Plane out four sides on a vertical shaper, using standard tools as furnished with the machine.

A—Set up for first piece,	20 min.
B—Rough out all around. Use 30 strokes per min. and a 0.03-in. feed per stroke. Total length of four sides to be planed 30 in.,	33 min

Note—Speed recommended is somewhat slow as the surface will be slightly hard from the burning operation. This can, however, be readily cut.

C—Finish four sides, using 60 strokes per min. and a 0.02-in. feed per stroke,	25 min.
Set up for subsequent pieces, each	5 min.
Planing subsequent pieces, rough and finish,	58 min.

Operation 4—Burr corners first piece,	10 min.
Burr corners subsequent pieces, each	5 min.

Summary

Total time first piece in each lot.....3 hr., 33 min
Total time each for subsequent pieces, 2 hr., 8 min.
Total time for four pieces in lot.....9 hr., 57 min.
Total time each for four pieces .....2 hr., 30 min.

Note—For cutting out the metal, with the gas torch, there will be a gas and oxygen consumption amounting to approximately 75c. each.

Solution That Won the Other Prize

In considering the problem, it is assumed that the work has either been machined on the outside, or that it is of sufficiently even surface, so that it may be strapped on two parallels, this method of holding being recommended for each of the machine operations.

The first operation would be to láy-out and scribe a distinct line representing the hole to be cut, also a line about $\frac{3}{32}$ in. inside of the first line. In one corner, tangent to the second line, prick-punch for a ½-in. drill. The time for this operation, by an ordinary machinist, would average five min. per piece, using tools from his kit.

Second operation—Drill a ½-in. hole, using any suitable upright-drilling machine and a ½-in. high-speed steel drill. The time for the operation, running the drill at 611 r.p.m. and a feed of 0.008 in. per rev., allowing set-up time of five min., would be six minutes.

Third operation—Burn out the center to the roughing line, using any one of several makes of gas-torch cutting machines. Data issued by a large welding equipment company show that with a No. 4 tip the cutting of steel 4-in. thick can be accomplished at the rate of 4½ in. per minute. For this operation the cutting time, including five min. each for set-up would be thirteen minutes.

It is possible, with the equipment specified, to start the torch at some point inside of the actual line to be cut, without any previous operation. This, however, requires so much time to preheat before the flame will burn through, that quicker and better results would be obtained by drilling a starting hole as called for in the second operation.

Fourth operation—Use any standard vertical shaper or slotter equipped with a circular-index table, this to be used to assist in quickly bringing the general contour of the piece parallel with the regular feeds, lateral

and cross, of the platen of machine, used for making the cut.

It is possible to burn the contour so that one roughing and one finishing cut in the shaper will be sufficient to size the hole properly, using a regular "round-nose" slotting tool 1½ in. in diameter for the ¾-in. radius in the corners. The roughing chip can be made at 1 in. per min. and the finishing chip at ½ in. per min. Ordinary measuring tools may be used to produce whatever accuracy may be necessary. Including the set-up time of five min., the total time for this operation would be approximately 101 minutes.

The following is a summary of the operations:

Operation 1—Lay out	5 min.
Operation 2—Drill ½-in. hole	6 min.
Operation 3—Burn hole	13 min.
Operation 4—Rough and finish shape hole	101 min.
Total	125 min.

Some of the allowances or times might be questioned, but judging from modern practice the method of procedure in each case is practical and should be accomplished in the given time. The time offered by other contestants was in one case identical and in others close, but as mentioned, they were disqualified through neglect of detail, an inefficient means of performing a minor part of the work, or by the use of some impractical tool. The editors of the *American Machinist* take this opportunity of thanking those who took part in the contest.

What the Cutter Marks Tell

By Donald A. Hampson

END, or face, milling is ordinarily chosen for work upon parts of comparatively light section, particularly when more than ordinary accuracy is required in the product. The main reason for selecting this method of cutting is that it is easier to keep the spindle of a milling machine tight longitudinally than it is to get plain milling cutters ground or set truly concentric, or to get an arbor for them that is stiff enough not to be deflected under the varying pressures of the cut.

Because end milling is applied to operations requiring a special degree of accuracy, the condition of the machine in respect to alignment of spindle and looseness of bearings, demands careful attention. When trouble develops from these causes it is often difficult to locate it exactly, or even to be able to say definitely that it is the fault of the machine. The operator's gages may show that the work is not being produced correctly, but they furnish no clue as to the cause.

Obvious Marks Neglected

The toolmarks upon the finished work may, however, be depended upon to point out, not only the presence of physical faults in the machine, but to indicate plainly where the trouble lies; yet it is not uncommon for the man whose duty it is to seek and eradicate the difficulty to disregard completely the evidence supplied by such marks.

As a rule, the pressure of the cut will cause the main bearing to be worn toward the rear of the machine; though this does not necessarily follow, since some other factor—such as belt pull—may counteract the normal tendency. With the main bearing worn toward the back, the front half of the cutter will do all of the work, and the tool marks left upon the piece will be bowed toward the operator, while if the bearing is worn toward the front the marks will be left by the rear half of the cutter and bowed in the opposite direction.

If the spindle is "out" in either direction as above, the milled surface will show concave when tested with a straight-edge; the amount of concavity depending upon two factors, one of which is the diameter of the cutter and the other the angle at which its axis stands with relation to the true center line.

There is one sure indication of correct alignment of spindle, and that is when the marks of both sides of the cutter are left upon the work. When the alignment is correct, and the work passes completely across the cutter, the leading side of the latter will leave its mark most prominently, but there will be a noticeable mark left by the other side as the cutter trails and takes the spring out of the work.

Should the work show the mark of one side of the cutter for nearly the whole length and that of the other side for a space of less than the cutter's diameter, it would indicate looseness of the spindle; generally in the matter of thrust adjustment. Work that is out of square, or tapered, when the integrity of the holding fixture cannot be questioned, tells that one end of the spindle is higher than the other. This is a common trouble in duplex milling, where the two spindles may be in line in one plane but not in the other.

It is not always safe to say that because marks are left by the lower half of the cutter, or vice-versa, that the spindle is "out" in a vertical plane, but when it is also out in a horizontal plane those marks would be the telltale to point out the cause of the error. The more nearly the center of the work coincides with that of the cutter the easier it is to check this trouble.

Straddle milling, when applied to cuts that pass completely over the piece, are pretty apt to turn out satisfactory work. When error appears it may be traced to one or both of two principal causes: the teeth of the cutters may be ground inaccurately, so as to leave the work thin at the top; or there may be end play in the spindle. The former is not shown at all by the cutter marks and the latter only by the unevenness of the marks; which, however, speak very plainly to the experienced man.

A Case in Straddle Milling

A somewhat rare trouble in straddle milling may come from the spindle being pitched up or down and the outboard bearing set at the normal height, resulting in the constant flexing of the arbor. Under such condition the work will be thin at the top, but the cutter marks will give no indication.

When straddle mills do not pass clear across the work, the condition of the machine is clearly indicated by the cutter marks. End play is shown up, as usual, by the irregularity of the marks. When one side of the work shows marks running up and the other side marks running down it indicates that the spindle is out in the horizontal plane, or that the outboard bearing is not in line.

This latter is quite a common occurrence, and is usually caused by shifting the outboard bearing in an attempt to get it to line with a spindle, the bearings of which have become worn.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Repairing Micrometers—Discussion

BY C. L. HALL

After reading the article by H. J. Gustav Kopsch under the title given above, on page 357, Vol. 62, of the *American Machinist*, and the remarks by Chester H. Franklin on page 508, of the same journal, it occurs to the writer that a description of the method and tools used for reconditioning micrometers in one of the largest tool and contract shops in the country, might be of interest.

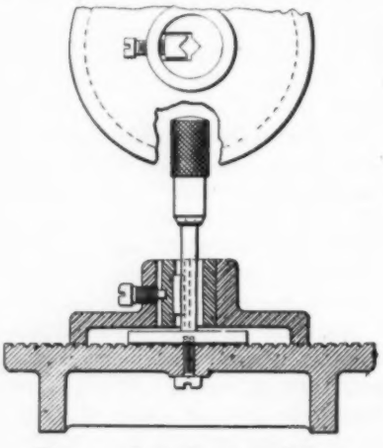


Fig. 1—Lapping a micrometer spindle

The writer heartily agrees with Mr. Franklin when he says that the anvil should be square with the axis of the screw, and the drawings accompanying this description will clearly illustrate how this is accomplished.

The equipment used for lapping the end of the spindle is shown in Fig. 1. It consists of a steel disk about 4 in. in diameter, having a hub in the center that contains an accurately made V-block to receive the spindle of the micrometer. A clamp and setscrew are provided to hold the spindle securely in place. The under side of the steel disk is relieved as shown, leaving a bearing surface on the edge about ¼ in. wide. This narrow bearing surface is accurately ground and lapped square with the V-block.

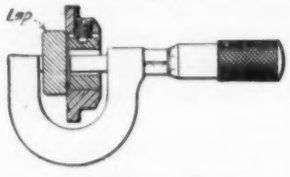


Fig. 2 — Lapping a micrometer anvil

The lap consists of a disk about 2 in. in diameter and ¼ in. thick, and is mounted on a small bench plate. The lapping is done in the usual manner by sliding the disk around on the surface of the bench plate with an irregular motion. When the lap becomes worn hollow it can be readily removed and the surfaces ground flat and parallel on a surface grinder. The surface of the bench plate is cross-scored with dirt grooves so that any lapping compound that accidentally gets on the surface of the plate will be immediately scraped into the grooves before it has a chance to damage the bearing surface of the disk.

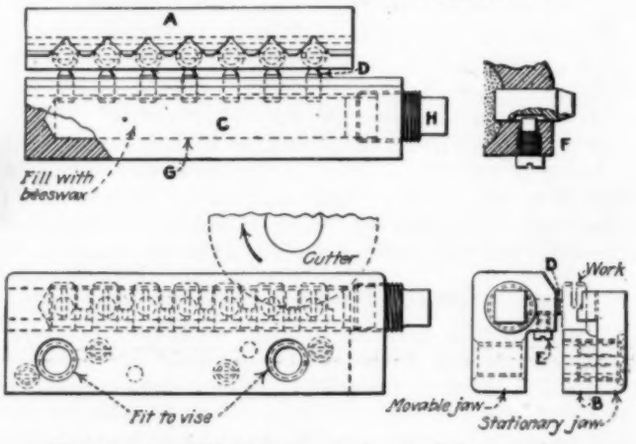
In lapping the anvil of the micrometer, we use the device shown in Fig. 2. This is a disk of similar construction to that used for the spindle end, but smaller so that it will go into the frame of the micrometer. It is clamped to the spindle, and a small rectangular lap about 2-in. long, held in the fingers, is passed back and fourth between the disk and the anvil face. It will be noted that both in lapping the spindle end and the anvil face, we are locating from the spindle, thus securing surfaces that are square with the spindle axis and therefore parallel to each other.

As the accuracy of the whole process is permanently "built into" the two disks by making the V-blocks square with the bearing surfaces, the problem of properly reconditioning a micrometer is considerably simplified.

Milling Fixture for Use in a Vise

BY FRANK WALDO

The unusual type of milling fixture shown in the illustration is used for the gang milling of slots in pins that are used in a calculating-machine unit. There are seven pins held at one setting, and as they have a small variation in diameter it was not possible to use a single flat surface for clamping purposes.



Fixture in which beeswax is used to equalize clamping pressure

The fixture comprises a movable and a stationary jaw, fastened to a standard machine-vise in place of the flat jaws. The jaw *A* is made with seven V-blocks, cut from a solid piece of tool steel. Underneath the projecting part is mounted the block *B* that acts as a stop for the

IDEAS FROM PRACTICAL MEN

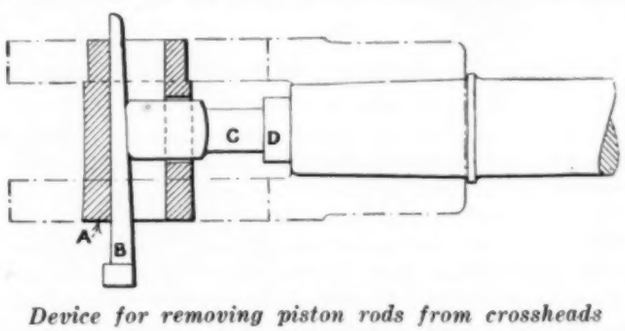
lower ends of the pins. The jaw *C*, also made of tool steel, has seven plungers *D*, located opposite the V-blocks, these being held in position and limited in their motion by screws *E*, as shown in the enlarged view at *F*. The rear ends of the plungers enter a hole *G*, drilled from the end of the jaw and tapped for the plug *H*. The hole is filled with a commercial grade of beeswax and the plug *H* screwed in far enough to compress the wax and force out the air.

After the correct pressure has been adjusted to the plungers, the vise is used in the regular manner, with the result that an equalized-clamping action is given each piece of work. The consistency of beeswax is such that it cannot run out through the threads and will not leak through the plunger holes. This fixture is one of many in which beeswax can be adapted for the clamping of small work of slightly varying diameter.

Piston-Rod Puller

By G. Charles Hoey

On certain classes of locomotives, it is necessary to disconnect the piston rod from the crosshead in order to remove broken or worn piston rings and apply new ones. However, while doing this it is not desirable that one should mar or deface the rod or the crosshead. A puller that does not fit the crosshead properly will



Device for removing piston rods from crossheads

deface the tapered wrist-pin hole, while the method of heating the boss around the rod-fit, by an oil or gas torch, sets up undesirable strains in the crosshead body.

The puller or pusher, shown herewith consists of a hollow wristpin *A*, which is of proper diameter and taper to fit the wristpin hole correctly, a tapered wedge *B*, and a block *C* loosely fitted to a slot in the side of wristpin and provided with a tapered butt to fit the wedge *B*. Block *D* may vary in thickness to suit conditions.

The wedge *B*, block *C* and blocks *D* are standard for all classes of motive power.

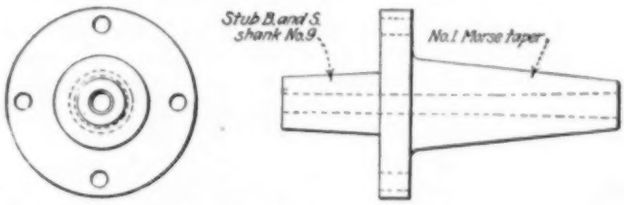
The wristpin *A* is individual for each class of power.

In service the wristpin *A* is slipped into the wristpin hole when the slot is on the bottom quarter. Block *C* is put into place and *A* rotated 90 deg. to line up with the piston-rod end. If necessary block or blocks *D* are applied, and wedge *B* is lightly driven into place to apply enough strain to hold block *D* in place. Sufficient force is then applied by man power and a sledge to force the rod forward and out of the crosshead.

An Extension for the Spindle Nose

By Roy A. Dressler

The usual method of holding small tools such as end mills, drills, reamers, etc., in the milling machine, is by the use of taper sockets or sleeves. This method has been found unsatisfactory by the writer, for the reason that it is often necessary to use one or more small sleeves placed within a larger one. Tools so held will



Nose extension for the milling machine

often not run true and, since their support is weak, light cuts only can be taken. But the chief difficulty with such an arrangement is that the limitation of the saddle movement in line with the spindle, prevents the work from being brought close enough ot the tools.

These difficulties were overcome by making the extension shown in the illustration. The extension was provided with a stub shank having a No. 9 B. & S. taper to fit the spindle of the machine, and with a flange for attaching to the spindle nose by four capscrews. The other end can be made of any length to suit the work in hand. The one illustrated projects 4¾ in. beyond the spindle nose and has a No. 1 Morse taper hole. By its use it was possible to obtain a surprising rate of feed and depth of cut, due to the rigid support given the tools.

The extension was designed to fit the spindle of a No. 1 Milwaukee milling machine, but with slight changes in some of the dimensions, it could be adapted to other machines.

A Cutting Compound for Drilling Hard Spots in Steel

By Wm. P. Hamilton

We recently had some work to do on a part made of 5 per cent nickel steel on which an electric welding operation had been performed.

Holes had to be drilled across the spot that had been welded, but, as might be expected, the material in the neighborhood of the weld was so hard that we had little success in getting the drilling job finished. The presence of some machined surfaces prohibited annealing.

After trying turpentine and all the cutting compounds we could lay out hands on, without success, we mixed up a solution that I remembered had been used a good many years ago.

The ingredients in this old-time compound are:

1 part powdered sulphur
1 part cylinder-oil
2 parts castor oil

This proved satisfactory and enabled us to finish the job without further trouble.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Allowance for Splitting and Grinding Piston Rings

Q. I should like some information as to the size that step piston rings should be turned before they are split. How much is allowed for the saw cut and for the grinding operation, measured on the diameter of the cylinder, and how are the rings held for grinding?

A. The proper width of saw cut and the finish to allow for grinding varies with the size of the ring. Assuming a 3.500-in. diameter, for example, a $\frac{1}{8}$-in. width of saw and a finish of $\frac{1}{64}$ on the diameter, or 0.0156 in. are ample.

To reduce this to a diameter measurement, the distances on the circumference for the saw cut must be divided by π and added with the required finish to the finished diameter. Thus $\frac{1}{64} + \frac{1}{8} \div \pi + 3.500 = 3.555$ in., the diameter to which to turn the pot.

Piston rings are generally finished a number at a time. They are compressed into a cylinder whose inside diameter is greater than the finished diameter by the finish allowed for. In the example given this measurement would be 3.500 in. + 0.0156 in., or 3.5156 in. Washers that will pass through the cylinder are placed against the ends of the gang of rings. An arbor is passed through the washers and adjusting nuts are tightened to clamp the rings between the washers and hold them securely in place. The cylinder is then removed, and the arbor with the rings is mounted on centers for the finishing operation.

Machine for Assembling Radiators

Q. We have a foreign client who desires the name of a company building a machine for assembling push-nipple radiators.

A. We believe there is no company that builds such a machine for the market, and that the concerns who use them have either built them in their own shops or have had them made to order.

We advise submitting the inquiry to firms that build machinery for press work that they may secure the particulars and adapt their designs in order to bid.

Annular Gearing

Q. We are considering the use of an annular-gear speed-change unit, but would like some reliable information as to whether this type of gearing is self-locking or not. In other words, would it be possible to apply a load at the slow-speed end and reverse the gears, or can they be operated only from the high-speed end?

A. The annular unit will overhaul, the torque required being theoretically in step with the gear ratio. The unit, in fact, will act the same as any other two-gear speed-change combination. Naturally, as the ratio increases the effort to cause it to overhaul will correspondingly increase to a point where the unit is not practical as a speed-increasing medium.

We suggest that you get in touch with the representative gear makers and the manufacturers of speed-change units, to whom you can submit your actual data for analysis and recommendation.

Cutting Gear Teeth

Q. I would like to know which method is considered best or which is most used for the manufacture of cycloidal gears, the Fellows process, the hobber or the single cutter.

A. If the quantity is small, we should prefer the single-cutter method, since it requires the least outlay for equipment.

If the quantity is large, it will be a "toss-up" whether to hob them or cut them on a Fellows gear shaper.

On the other hand, there are a number of companies who specialize in the business of gears, and we suggest that you investigate their prices and deliveries before going to any expense to set up to do the work yourself.

Initiating Equipment and Specifying Types

Q. Have any conclusive data ever been gathered as to who in an organization initiates an equipment installation and who specifies what equipment shall be considered?

A. The McGraw-Hill Co. employed Ernst & Ernst to make just such an investigation, and from concerns which represented over $7,000,000,000 of capital the following was found to pertain, the names being listed in the order of their importance in each case:

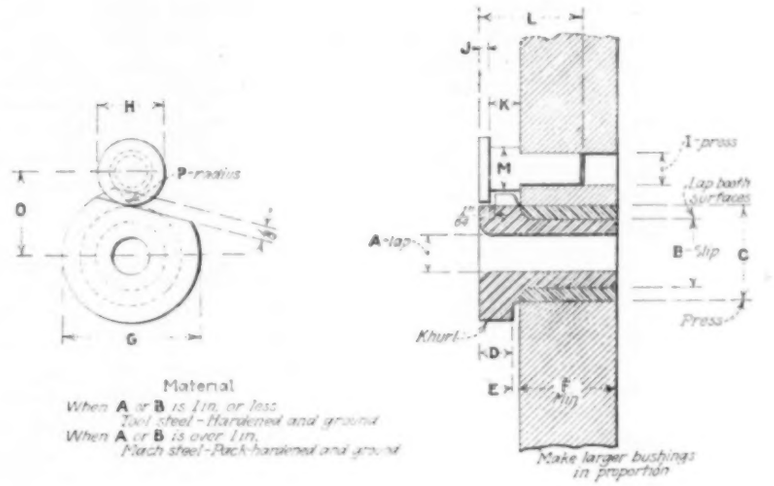
INITIATING EQUIPMENT INSTALLATIONS

Superintendent or works manager
General manager
Engineering department, chief or consulting engineer
President
Master mechanic or chief electrician
Purchasing agent
Vice-president, treasurer and other officers
Others
Directors

SPECIFYING TYPE AND MAKE OF EQUIPMENT

Superintendent or works manager
Engineering department, chief or consulting engineer
General manager
Purchasing agent
President
Vice-president, treasurer and other officers
Master mechanic or chief electrician
Others
Directors

Drill Bushings, "Slip" Type



A	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
B	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 1/4	1 5/16
C	7/16	1/2	9/16	5/8	3/4	13/16	7/8	1	1 1/16	1 1/8	1 1/4	1 5/16	1 3/8	1 7/16	1 9/16	1 5/8
D	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8
E	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	1/8	1/8	1/8	1/8	1/8
F	7/16	1/2	9/16	5/8	3/4	13/16	7/8	1	1 1/16	1 1/8	1 1/4	1 5/16	1 3/8	1 7/16	1 9/16	1 5/8
G	11/16	11/16	13/16	13/16	1 1/16	1 1/16	1 3/16	1 5/16	1 5/16	1 7/16	1 9/16	1 9/16	1 11/16	1 11/16	1 13/16	1 15/16
H	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	1/2	1/2	1/2	1/2	1/2
I	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	1/4	1/4
J	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	1/8	1/8	1/8	1/8	1/8
K	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8	3/8	3/8
L	11/16	11/16	11/16	11/16	13/16	13/16	13/16	13/16	13/16	13/16	13/16	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4
M	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	5/16
O	1/2	1/2	9/16	9/16	11/16	11/16	3/4	13/16	13/16	7/8	15/16	31/32	1 1/32	1 1/32	1 3/32	1 5/32
P	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	9/32	9/32	9/32	9/32	9/32

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Technical Abstracts

The Tool Crib

Anker L. Christensen, engineer of the tool and material storage department of the Worthington Pump and Machinery Corporation, points out that tool cribs are seldom left where they are originally placed. Bins and racks should therefore be so arranged and standardized that all parts are interchangeable and easily moved. All units of the bin system should be of the same size. They should be small enough to be easily handled and should be so designed that they may be fitted into a room of any shape and size with the greatest possible enocomy of space.

Illustrations and descriptions are given of the bins designed by Frank B. Gilbreth. The inside dimension of each section is 24½ in. each way and 17 in. in depth. By a combination of bins lying flat and standing up, almost any space can be filled to good advantage. These bins were originally of wood and some plain boxes were remodeled for this construction, but the use of pressed steel storage bins has become general during the past few years.

The balance of this article deals with desk and clerical equipment and the method of marking bins. One point noted is that tool cribs should preferably be painted white, not only to give it a clean appearance but to increase the light in the toolroom. Each bin should be marked with a symbol and the size of the tool it contains. The marking should be visible to the man of average height. —*Management and Administration*, June, p. 537.

Heat-Treatment of Cast Iron

Fred Grotts of the Caterpillar Tractor Co., states that it has hitherto been considered impractical to heat-treat cast iron; also that, once cast, if the iron was too hard for machining the part was usually sent to the scrap pile. The purpose of this paper is accordingly to show that the physical properties of cast iron can be very radically modified by suitable heat-treatment. Also that the addition of alloys as well as close chemical control of the cupola will give results that are very desirable. The possibilities in connection with short time malleabilizing are discussed, as well as the salvaging of defective castings by means of a copper nickel alloy with the electric arc. — *Transactions of American Society for Steel Testing*, June, p. 735.

Factory Lighting

Ward Harrison, of the General Electric Co., discusses the increase in production when good lighting finds its way into industrial plants. The results of nine tests, given in a table accompanying the article, show an average increase in production of 15 per cent, easily surpassing the increased cost. In one foundry the original lighting system provided only 0.2 foot-candle upon the work. The illumination was raised to 4.8 foot-candles. Although the amount is still below the recommended lighting standards, the production has increased 35 per cent.

At the plant of the Detroit Piston Ring Co. the average intensity of illumination was 1.2 foot-candles. A new system, consisting of 200-watt lamps in standard metal reflectors, spaced 7½ ft. apart, and mounted 9½ ft. from the floor, replaced the antiquated drop cords. An accurate record of production showed an increase of 25 per cent in 15 months.

At the Timken Roller Bearing plant, a test was made in the inspection department for a period of 10 weeks. The results showed very positive savings. The old lighting system consisted of four 200-watt and two 150-watt clear lamps in enameled-steel reflectors. They were widely and irregularly spaced, and provided a level of illumination of about five foot-candles. The new lighting system consisted of 28 lights enclosed in diffused bowls located on 8x10-ft. centers and mounted 12 ft. from the floor. With the higher level of illumination furnished by the new lighting system the production increased. Under the improved illumination the average increase in production was 12.5 per cent.—*Factory*, June, p. 932.

Waste

Norman L. Sammis gives twenty-six subjects for investigation in factory economy, as follows:

1. Raw material shrinkage before process.
2. Economy of materials in processing.
3. The factory salvage and disposal department.
4. The investigation of factory waste products for utility.
5. Better planned and executed storage.
6. Control of miscellaneous supplies.
7. Damage to goods between processes.
8. Material-moving equipment.
9. The reduction of loss to the Erie R.R. by fire prevention.
10. Losses in electric motors and their drives.
11. The reduction of cost of motor truck transportation.
12. Planning and facilitating factory traffic.
13. The packing of goods for shipment.
14. Correct lubrication by schedule.
15. The maintenance of buildings and structures.
16. Stores department economies.
17. Illumination according to correct standards.
18. Surveys to reduce the waste of electricity.
19. Surveys to reduce the waste of water.
20. The selection of the most economical fuels.
21. Specifications and tests of fuels.
22. The regulation of room temperatures and ventilation.
23. The location of toilets, drinking fountains and tool cribs.
24. Boiler room economy.
25. The regular determination of power costs.
26. Surveys to reduce the waste of compressed air.

He also suggests the use of graphic exhibits to reduce costs.

The article goes into careful consideration of the various means for studying the reduction of waste.—*Industrial Management*, June, p. 322.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

The Promise of More Air Mail Service

WITH the inauguration of night flying by the Air Mail came the real beginning of air transport for mail and express packages. The success of night flying over the Rockies, about as bad a flying country as can be imagined, leaves no doubt as to the results to be achieved by the New York-Chicago overnight service that began on July 1. Mail that leaves New York after business hours arrives in Chicago in time for the first delivery next morning.

One of our engineering friends who has been closely associated with aviation for several years but who is level-headed enough to see both sides of the question, has made some very careful studies of airplane operation costs. These studies convince him that, with a steady service and a sufficient number of planes to handle the traffic, the cost can be reduced to practically one cent a letter between New York and Chicago.

Allowing the present charge of two cents to stand, in order to cover the collection, delivery and handling at each end, this would allow a three-cent stamp to cover the total cost. If, for safety, we call it five cents a letter, we have a very low rate and enough margin to allow private carriers a profit and a good revenue to the Post Office department.

With the inauguration of the National Transport Co. in active service, the engineer in question predicts that in five years all first-class mail will be carried between New York and Chicago by plane. This will probably also apply to other points far enough apart to make the saving in time an important factor.

Suspicion Is No Proof of Conspiracy

THE more one studies the Supreme Court decisions in the Cement and Maple Flooring cases the clearer becomes the impression that they point the way to a new day in what might be called the government persecution of business. Persecution sounds like a harsh term but how else can we consider some of the actions instituted by the Department of Justice in the light of their final settlement by the Supreme Court?

In these two decisions the statement is reiterated that no proof of conspiracy was brought forward by the prosecution. The insistence on this point would certainly indicate that the Supreme Court believes it high time to call a halt on cases based only on suspicion. If this idea can be made to permeate the whole governmental legal and judicial fabric we shall have gone far toward a saner attitude on business success. It is to be hoped that prosecuting officers, members of regulatory commissions and even members of Congress will take heed of this indirect advice from the Supreme Court and conduct themselves accordingly.

Machinery Ousting Man

UNDER the above title a correspondent of one of New York's daily newspapers complains bitterly that we are keeping out human beings by means of our immigration laws but are welcoming every new piece of labor-saving machinery. He ends with a gloomy picture of that not far distant day when most of the human race will have vanished from the earth and the few remaining specimens will be slaves of the machines they have invented to serve them.

Here is truly a gloomy outlook but isn't the gentleman's perspective rather askew? As a matter of fact, the human race has increased to a point where life could not be sustained without the very machinery of which he complains.

Take the one important item of food and forget the others. Statisticians have proved conclusively that with the agricultural methods in vogue a century ago the modern city with its hungry millions could not possibly exist. In those days the farmers—and most people were farmers—produced but little more than enough to feed their own families and that little at a cost in physical exertion that was not much better than slavery. If you want a gripping word picture of the life of a farmer less than half a century ago read Edna Ferber's "So Big."

Machinery has taken over by far the greater part of the drudgery incident to agriculture before its development. Without it we would starve. By its aid we enjoy feasts undreamed of in the days of Lucullus and at a cost insignificant in comparison.

Just Suppose

JUST suppose that a poor ignorant customer who had never been anywhere came into a clothing shop and asked to be fitted out for a trip to Rio in January. Would the clerk sell him an expensive fur-lined overcoat and heavy woolen underwear just because he didn't know anything about the weather conditions in the place where he was bound?

It wouldn't be ethical, would it? And, besides, he would never come into that shop again after he had been stung that way.

Now suppose a man comes into a machinery showroom and asks for the best machine for drilling small holes in small parts. Should the proprietor sell him a high-power 4-ft. radial drill just because the customer doesn't know any better? Wouldn't be exactly ethical, would it? And very bad business, besides.

But, anyway,

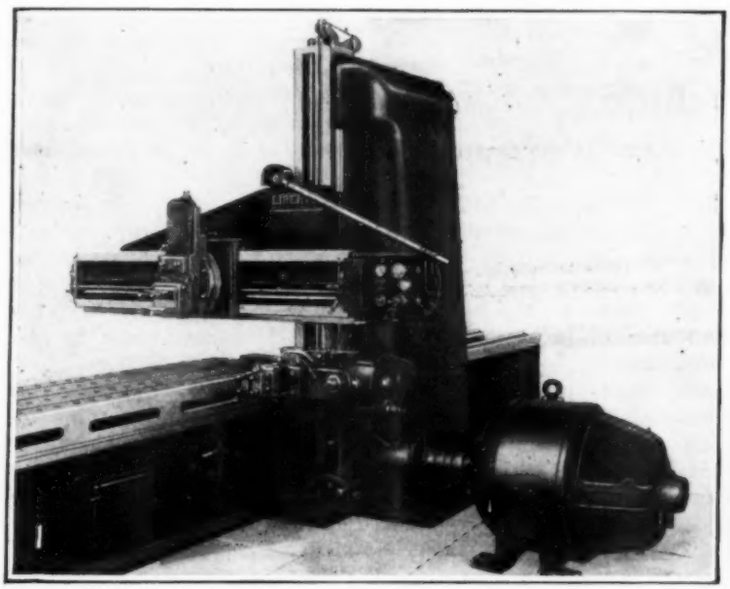
Just suppose.

Shop Equipment News

Liberty Open-Side Planer

To accommodate various classes of work that are adaptable to open-side planer operation, the Liberty Machine Tool Co., Hamilton, Ohio, has developed the machine illustrated. It has been aimed to offer the machine with rigidity equal to that obtained in the double-housing type.

The open-side planer includes the important features that have been incorporated in the double-housing machine. The knee, hung on extra heavy bearings on the column, is provided with an arrangement of gibs for locking in any desired position. Figs. 1 and 2 show the construction that is embodied throughout the machine.



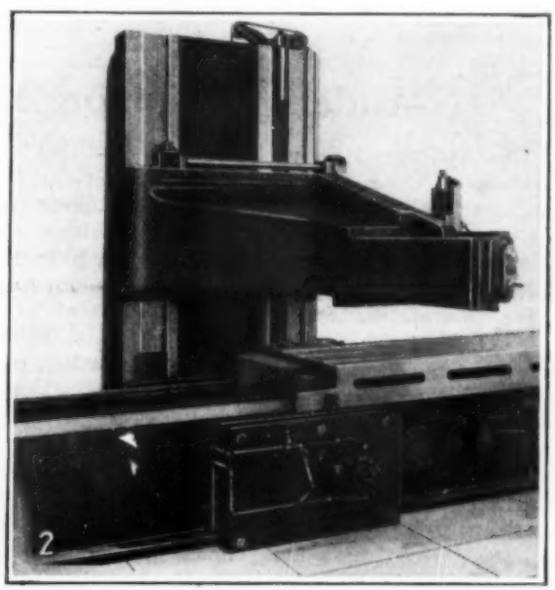


Fig. 1—Liberty Open-Side Planer. Fig. 2—Open side of planer

One motor is employed for driving the table, while independent motors are furnished for the rail and sidehead, eliminating all overhead work and making the cross-rail and the sidehead fully independent units capable of employing various feeds for rapid-traverse movement. Elevating or lowering the cross-rail, also the rapid traverse of the rail head vertically and horizontally, are accomplished by manipulating a single lever *A*, Fig. 3. With this arrangement it is impossible to engage two different movements simultaneously, furnishing a fool-proof control for the rail. Feeding of the head vertically and horizontally is controlled by the lever *B*, and the desired rate of feed is secured by turning the small handwheel *C*, which is connected with the dial *D* that shows the rate of feed for which the setting has been made. The motor that furnishes these movements is 1½ hp., receiving current through a protected trolley that contacts with conducting strips fastened to the housing. Either a.c. or d.c. may be used, and, if necessary, may be taken from a lamp socket. The screws that move the head on the cross-rail and the sidehead on the housing are held stationary, movement of the heads being accomplished by the rotation of the nut on the screw. The lever *E* provides a control for the horizontal feed of the head on the rail, or the vertical feed of the toolslide. The vertical movement of the toolslide is also accomplished by revolving a nut around a stationary screw held in tension; similarly, the screw for elevating and lowering the cross-rail is held stationary and in tension. A vertical shaft is provided for transmitting the power to the feed mechanism of both the railhead and sidehead. The transmission gears are so arranged that by throwing the lever, located at the lower portion of the base, in two different positions enables the feed to operate either at the end of one cut or just before starting a new one.

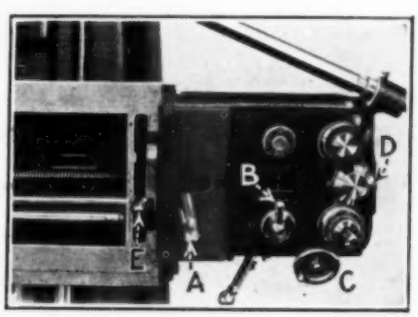


Fig. 3—Operating controls

The mechanism at the end of the cross-rail and the mechanisms controlling the feed and power rapid traverse of the side-head, and the feed reversing at the bottom of the housing, run in oil. Gages are arranged to indicate the level of the oil at these points.

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The planer bed is twice the length of the table, so that the last mentioned never extends beyond the ends. A balanced drive is secured through the use of herringbone gears that eliminates friction and side thrust. The gears are made of heat-treated steel and are contained in a box, cast in the bed, to run in a bath of oil.

It is claimed that on a test made on cast iron, taking a cut 1½-in. deep and a feed of ¼ in., that the maximum deflection at the outer end of the rail was found to be only 0.0035 in., indicating that the rigidity is similar to the double-housing type. The housing extends to the floor and is attached to the bed by bolts, fitted in reamed holes. Additional heavy dowel pins eliminate any movement between the housing and the bed. The last mentioned is of the double-wall type, ribbed both lengthwise and crosswise and webbed at the top. Provision is made for forced-feed lubrication, the pump and control valve of this system being located on the outside of the housing. A sight-feed attachment that enables the operator to see whether the system is functioning properly is provided. All oil entering the bearings is filtered through a sequence of filtering stations in the bed, then passing through a ½-in. felt wick.

Anderson Tapping Machine

The Anderson Die Machine Co., Bridgeport, Conn., has brought out a modification of its friction-driven, multi-spindle tapping machine which is adapted to the tapping of holes in small parts when the holes lie in three separate planes.

The notable features of the machine are the turret, or dial, and the individual fixtures by which the work-pieces are held and turned about to the different planes to bring the holes into line with the taps. The turret consists of an annular steel ring into which is fitted the work-holding devices, or fixtures, shown in Fig. 2, one to each indexing station.

The round shank of the fixture passes radially through the ring and terminates—inside the ring—in a peculiarly shaped rectangular knob. The loading station is at the right side of the dial, where the operator slips one of the work-pieces in a fixture each time one presents itself.

As the tapping head comes down, a plunger affixed to it strikes upon an exposed corner of the beforementioned knob, turning the fixture through a distance of 90 deg. (or whatever amount may be required) upon its own axis to bring the first hole into the proper plane to be tapped.

The first hole is tapped at the second station of the dial. At the third station a second plunger strikes another corner of the knob and turns the fixture 180 deg. (or, again, whatever may be necessary) to bring the second hole into the proper plane, and this hole is tapped at the fourth station of the dial.

After the dial indexes to the fifth position a third plunger strikes the knob and turns the fixture back to its original position, where it is presented in proper plane to tap the third hole and also to leave it in position for stripping.

The automatic ejector is a swinging arm, to be seen at the left in Fig. 1, attached to the head and moving with it. It is provided with two flat steel fingers which descend behind the work piece and, as the projecting pin in the swinging arm strikes against a stationary bar attached to the frame, the arm swings forward and pushes the work-piece out of the fixture.

The reason for turning the fixture

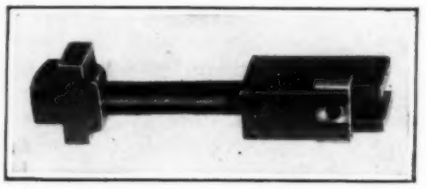

Fig. 2—Fixture to hold the work

before tapping the first hole is that by this combination of movements the tilting to position to tap the final hole leaves it in position to be stripped and reloaded.

Except for the reloading the movements are all automatic; the operator having nothing to do with them but to place a work-piece on each empty fixture as it presents itself to loading position. A spring-actuated detent, bearing on suitable flat spots in the round shank of each fixture, holds the last mentioned in tapping position until it is again turned by one or other of the plungers.

In the work shown, the planes are 90 deg. apart, but this is not necessarily so, as the position of the fixture at each stop is determined by the angle at which the flats are placed on the round shank and by the adjustment of the plungers.

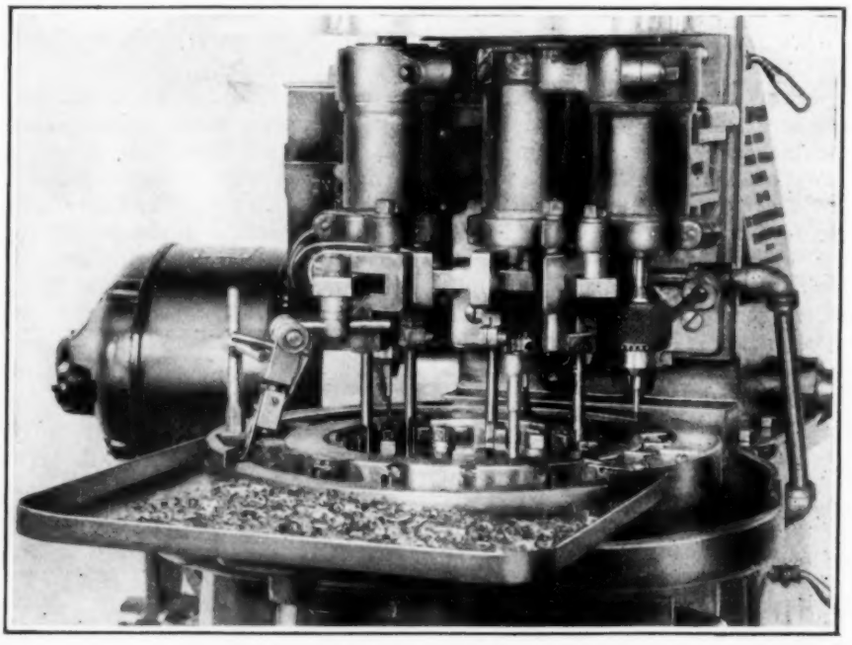

Fig. 1—Anderson Tapping Machine

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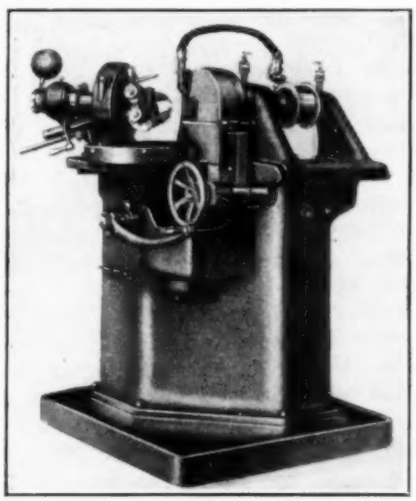
Union Twist Drill-Point Grinding Machine

The machine illustrated, for sharpening points of twist drills having right-hand spiral flutes and two lips, has been marketed by the Union Twist Drill Co., Athol, Mass. It will point drills so that the lips are equal in length, with a chisel point coming to the center of the drill.

The drill is held securely in a two-jaw chuck, operated by a hand lever, that provides a rapid movement of the chuck jaws. The jaws are adjustable laterally to furnish a similar clearance angle for different drill diameters. A graduated plate on the upper jaw is used for the setting of various diameters. The jaws may be adjusted vertically to obtain clearance angles as required. The machine is adjusted when assembled to produce a clearance angle of 12 deg., which has been found to be satisfactory for general work.



Union Twist Drill-Point Grinding Machine

The work spindle, carried in a housing, can be adjusted to give various included angles of drill points, ranging from 90 to 118 deg. The housing is carried on a slide operated by a hand lever, so that the point of the drill is moved across the face of the grinding wheel. The slide travels on roller bearings that are hardened and ground.

The front bearing of the chuck spindle is carried on ground-steel rollers, and the rear bearing is carried in a bronze box, adjustable longitudinally, so that the chuck and the spindle can be kept in a correct position relative to the spindle boxes. The chuck spindle has a rotary movement of approximately 110 deg. and may be varied by the setting of adjustable screws.

The grinding wheel, of the ring type, 8 in. in diameter, is held by a flange, clamped to the end of the wheel spindle. The wheel head has an adjustment of 4 in. to compensate for the wear of the wheel, also allowing movement of the wheel to the correct position in relation to the drill. A graduated collar on the adjustable screw provides a means of moving the wheel to the same position for both lips of the drill, which is an essential.

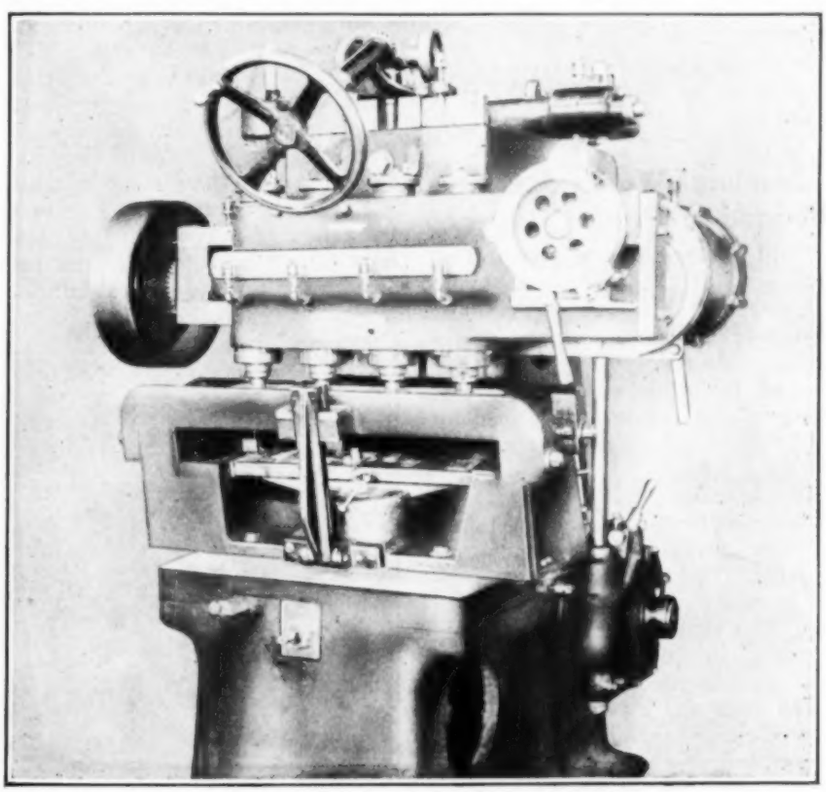
All drills, both of high-speed and carbon steel, should be ground wet, with an ample supply of water on the work. A pump and tank with suitable piping is provided that supplies a sufficient flow of water to the wheel. The machine is equipped with suitable water and splash guards.

A diamond holder, clamped in the chuck jaw in the same manner as the drill, is traversed across the face of the wheel, insuring the cutting face to be parallel with the travel of the drills when they are held in the chuck.

The machine is built in two sizes, the smaller size, known as No. 2, accommodating drills from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter, and the larger size, No. 3, having a capacity from $\frac{3}{8}$ to 2 in. in diameter. A countershaft equipped with tight and loose pulley 10 in. in diameter for a 3-in. belt is provided. The recommended speed is 550 r.p.m. The floor space required for both machines is 45x40 in., and the weights are: No. 2, 1,580 lb., and the No. 3, 1,850 pounds.

Coulter Profiling Machine

A modification of the Coulter profiling machine has been made by its builder, the Automatic Machine Co., 115 E. Washington Ave., Bridgeport, Conn., to adapt it to the work of milling the combustion chambers in the heads of the new 8-in-line motors, without sacrificing its rigidity by reducing the distance between centers of its spindles, or adding to



Coulter Profiling Machine

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its complexity by increasing the number of spindles.

The details of the modified machine remain the same as those of the original four-spindle machine described on page 1322, Vol. 52 of the *American Machinist* except that the roller of the cam that actuates the traverse movement of the sliding head is now mounted on a block, the relative lengthwise position of which may be shifted within the limits of a rectangular opening in the head.

The position of the block is controlled by means of the small index handwheel to be seen at the right end of the head. This handwheel is provided with adjustable carriers for spring-actuated latchpins, so that when the work has been completed on four of the profiled contours of the piece held in the fixture, the latchpin is withdrawn and the block shifted by turning the handwheel until it locks in the second previously determined position, which brings the cutters in action on the spaces between those already finished on the first movement. An 8-in-line head is thus completed in two movements, using but four spindles, and without disturbing the set-up of the piece in the fixture.

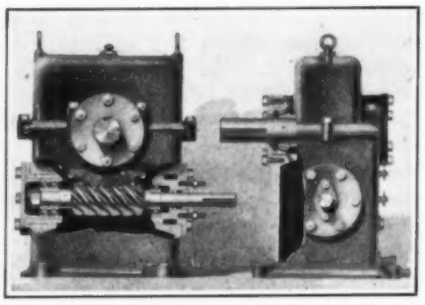
The machine weighs approximately 6,000 lb. and occupies a floor space of 5x6 ft. It is driven either by belt from an overhead line or from an individual motor mounted at the rear of the base.

Cleveland Worm & Gear Reduction Unit, Type AT

The Cleveland Worm & Gear Co., 3275 E. 80th St., Cleveland, Ohio, has marketed a series of standard wormgear - reduction units, designated type AT. The drives are adapted for direct-connected loads, incorporating features developed by the company for its line of units for overhung loads.

The housing of the unit is of square design that has been found to offer advantages of ample oil capacity. The outside of the housing is smooth, having no projecting ribs. This tends to simplify cleaning. Petcocks for determining the oil level are conveniently located.

The gear shaft is mounted with tapered-roller bearings to absorb the impact and shocks when the unit is in service. The gearing furnished is of the automotive type. The worm is machined from a solid nickel-steel forging, heat treated and ground. The gear consists of a phosphorized-bronze rim, chill-cast, on a cast-iron center. The teeth are hobbed from the solid casting. The



Cleveland Worm and Gear Reduction Unit, Type AT

worm is mounted in heavy ball bearings, of which the inner bearing is of the combined radial and thrust type, capable of taking thrust in both directions and permitting the worm to be rotated in either direction to suit the requirements of an installation. The bearing at the outer end of the wormshaft is of the straight radial type, arranged to float in the casing, and accommodates the lineal expansion of the worm. All bearings and gear contacts are lubricated by splash from the large oil reservoir in the bottom.

The distances between the worm and gear centers and between the shafts and the bottoms of the housing conform to the standards established by the company. The units are available with ratios ranging from 4 to 1 to 100 to 1, and load capacities from ¼ to several hundred horsepower in graded steps.

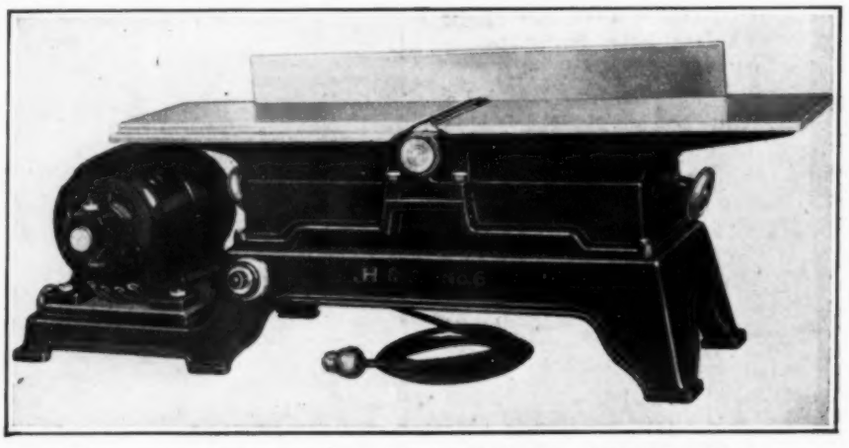
Heston and Anderson Portable, Electric Bench Jointer, No. 6

A portable, electric bench jointer, intended for the pattern shop and production work on wood parts, has been added to the products of Heston & Anderson, Fairfield, Iowa. It is a self-contained unit, balanced to run quietly and smoothly. The weight of the machine is such that it may be easily installed wherever needed.

The tables are made of close-grained cast iron, finished smooth and level. The back table is cut out for rabbitting. Both are raised and lowered by handwheels conveniently located, each table being independently adjustable for leveling and aligning.

The base of the machine is a solid one-piece casting, to which the jointer is securely bolted. The motor is mounted on a slide that can be drawn back by the handwheel, maintaining the proper tension on the driving belt and offering a flexibility to the drive that allows the jointer to be used to full capacity without strain or injury to the motor. Provision is made so that all chips fall through the base, where they can be caught by a tray or suction pipe.

The jointer is fitted with a cylinder-type safety head, having three high-speed steel knives ⅛ x ⅞ x 6 in. The head operates at a speed of 3,500 r.p.m. The driving motor is a ½-hp., induction-repulsion type, for 120 to 220 volt, 60 cycle, single-phase current. Motors for any other current can also be furnished, or the machine can be furnished less motor, the sliding base being arranged to



Heston and Anderson Portable, Electric Bench Jointer, No. 6

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accommodate any make of motor of this horsepower. The motor may be operated from a lamp socket, being controlled by a switch placed conveniently on the base of the machine. Ten feet of heavy motor cord, with an armored plug, are attached.

The weight of the complete machine is 185 lb. The length over the tables is 33 in., and the overall length is 40 in. The height of the machine is 12 in. to the top of the tables. It is fitted with a fence that can be tilted to any angle up to 45 deg. Either phosphor-bronze or ball bearings can be furnished.

Luehrs Semi-Automatic Drilling and Tapping Machine

The Luehrs Co., 118 St. Clair Ave., N. E., Cleveland, Ohio, has placed on the market the semi-automatic machine for drilling, tapping and counterboring small iron, steel, brass or aluminum parts. It is provided with two independent motor-driven drill spindles, two tapping spindles and a twelve-sided turret that revolves on a horizontal axis. Twenty four jigs can be mounted on the turret face as shown.

The machine differs from the usual construction practice since there are practically no castings used. The main frame, turret, drilling and tapping subassemblies, oil guards, hopper and chip pans are built of electrically-welded steel plate and structural bar, producing a unit that is light in weight, yet rigid in construction.

The turret is indexed by a continuously revolving single-thread screw operating on pins secured to the face of the index plate that is keyed to the turret shaft. The main feed shaft revolves continuously and, in addition to the turret turning screw, carries a face cam that operates a lever which in turn operates the locking pin that seats in the hardened and ground bushings in the periphery of the index plate. In operation the index pin is withdrawn during the time the turret is turning from one position to the next and then reseated, holding the turret firmly while the tools are operating.

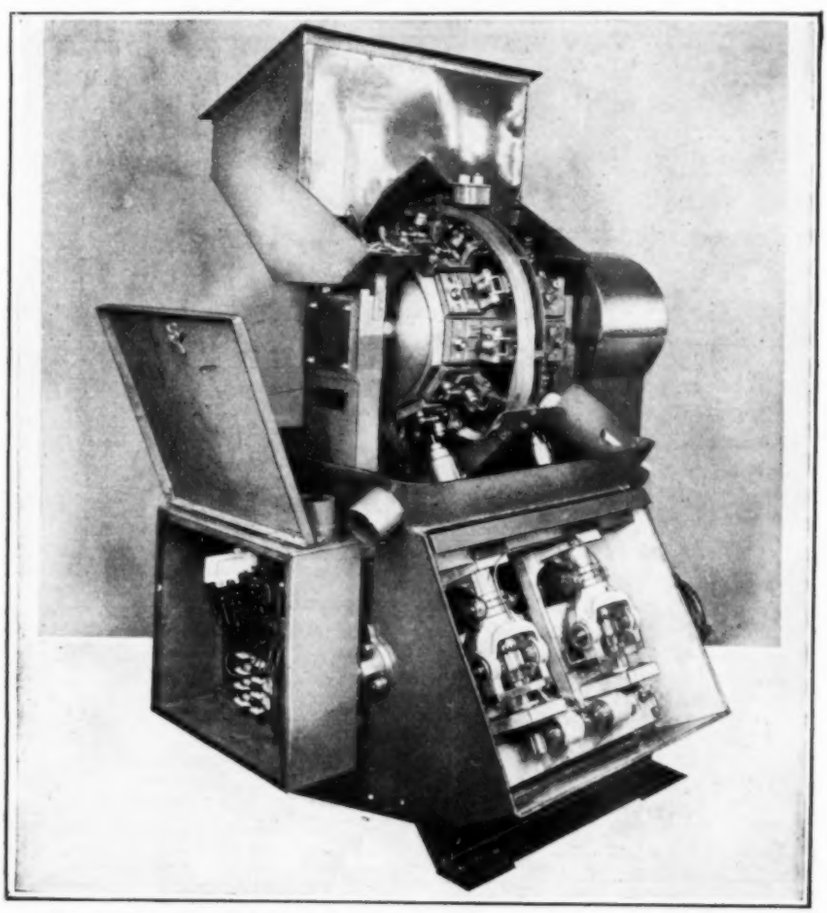


Fig. 1—Luehrs Semi-Automatic Drilling and Tapping Machine

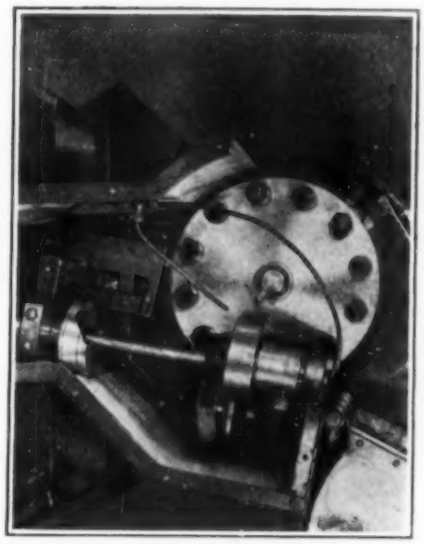


Fig. 2—Turret-indexing mechanism

The main driving motor is a ¾ hp., 3 phase, 60 cycle, 220 volt, 1,800 r.p.m. ball-bearing type, mounted on a tripod that is bolted to the side of the machine, transmitting its power through a flexible coupling to the main drive shaft. The control of the motor is by push button, mounted in front of the operator and convenient to either hand. The push-button station starts and stops the motor by means of a thermaload starter. This type of control enables the operator to instantly stop the machine in the event something goes wrong or should he fail to place the work properly in the jig.

The work shown in the illustration is the ball of a gas-stove cock that is assembled to a porcelain handle. The work is located in a V-block and a cup-shaped block. The turret advances one station on the turret face that carries the two jigs. The drilling, counterboring and tapping are accomplished at the various stations as the turret is indexed, then the clamping arms are opened so that the work is released, at a predetermined point, allowing it to drop in the chute leading to tote boxes. The clamping arms are held open so

SHOP EQUIPMENT NEWS

the operator may load the work as the turret continues, this being the only hand operation required. The drill spindles operate at 3,600 r.p.m. each spindle having an independent ¼ hp., 3 phase, 60 cycle, 220 volt motor, controlled through a snap switch. At 3,600 r.p.m. the cutting speed of the counterbore is 410 ft., the No. 17 drill penetrates $\frac{7}{16}$ in. The taps are $\frac{5}{16}$ in., stove-bolt size, and cut a thread ¼-in. deep. They

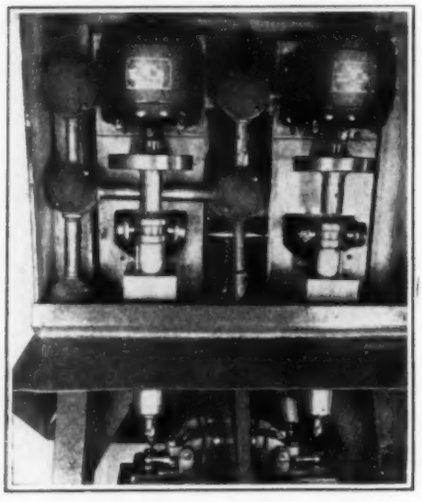


Fig. 3—Individually-driven drilling spindles

operate at 1,800 r.p.m. and are driven by friction cones. The work is yellow brass and is produced at the rate of 42 pieces per minute.

The main drive motor operates the two tapping spindles through bevel gears and the main cam shaft through worm and wormgear. The reciprocating motion of the drill and tapping spindles is obtained from a double-faced cam that operates a set of rocker arms. All working parts of the machine are enclosed in oil-tight casings and are flooded with a copious supply of oil from a ½-in. pump, turning at motor speed.

Mounted above the turret is a hopper that holds the work to be machined. Two feed chutes, one on either side of the turret supply the work so that an operator stands directly in front of the machine with the turret turning away from him. A piece is taken from each feed chute and placed in the jig opposite.

The features claimed for the machine are high production, ease of control, operation on a minimum amount of power, and that it is correctly proportioned.

Oeking Combination Punching and Shearing Machine

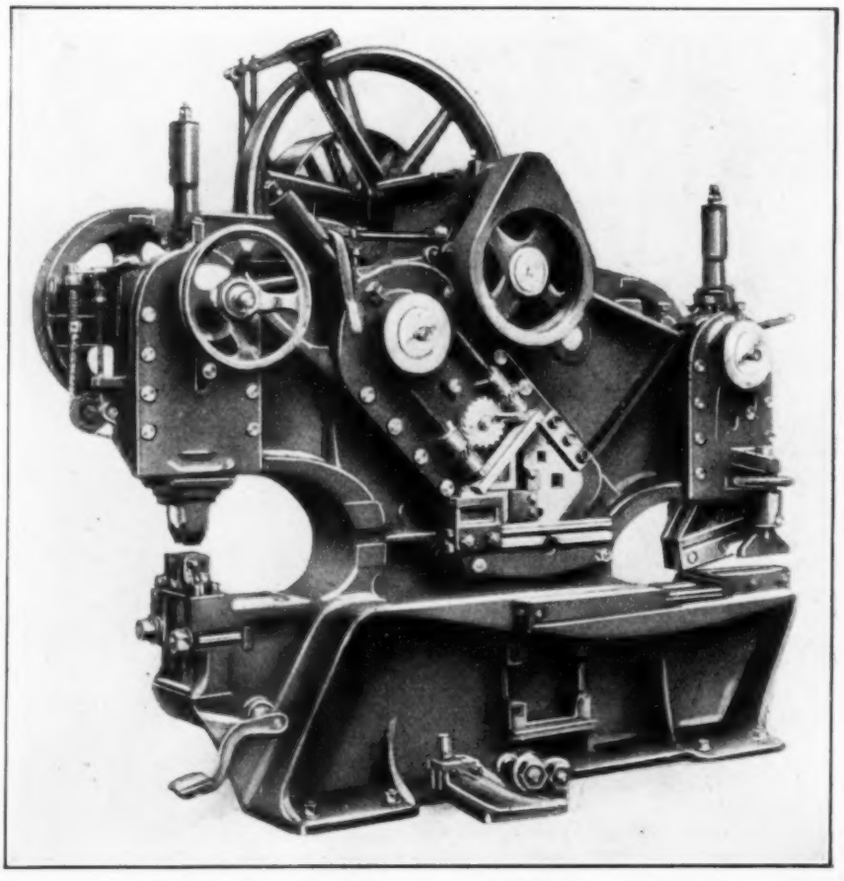
To provide for the handling of a wider range of material, including modern shapes and sections, the Oeking Steel Works, Dusseldorf, Germany, has redesigned its combination punching and shearing machines that are handled in this country by Julius Blum & Co., 532 West 22d St., New York, N. Y. The machines are manufactured in a series of sizes, the smallest being the No. 13 that will split $\frac{5}{16}$-in. plates and cut 3½-in. angles, with a punching capacity of $\frac{7}{8}$-in. holes through ½-in. material. The largest size machine is the No. 32, that will split 1⅜-in. plates, cuts 8-in. angles and punches a 1¾-in. hole through 1¼-in. material.

The frame of the machine is made of solid cast steel and is constructed to provide durability. The slides, also made of steel, are adjustable. The covers of the slides are attached to the body by pin-bolts, so that they cannot work loose. The bearings have large surfaces, are bronze-bushed and provided with ring lubrication.

The flywheels and driving gears are located on one side of the machine to be out of the way of the operator. A slanting center slide is provided so that mitering cuts can be made without lifting the bar to be cut. The plate shear has longer knives than employed in former models. The lengths vary from 13 to 16 in. as compared with the former lengths of 9 and 11 inches.

The punch is arranged for punching both webs and flanges of structural shapes, and the height of the machine is designed for handling broad-flanged Bethlehem shapes. The punch is provided with a lowering device to ascertain the center mark before punching. Both hand and foot levers are provided to throw the machine in gear. The springs and the gears are inclosed to safeguard the operator. Either belt drive or direct-motor drive may be furnished as desired.

The assembly has been designed to make the parts accessible and to facilitate tool change.



Oeking Combination Punching and Shearing Machine

News of the Week

Twelfth National Foreign Trade Convention Studies World Markets

Fullest use of mechanical devices is necessary

Utilizing every moment of the three days devoted to its twelfth annual convention, the National Foreign Trade Council concluded this year's meeting with a thorough understanding of world trade problems and a very definite idea of the methods that should be applied to build up American participation in foreign trade to the fullest extent. The meeting, held in Seattle, Washington, June 24 to 26, was attended by representatives of large industrial concerns and by officials of our own and other governments.

The opening address, on "The Foreign Trade Outlook," was delivered by James A. Farrell, president of the United States Steel Corporation. He cited statistics to illustrate the immensity of foreign trade, the value of which in the aggregate in 1924 was sufficient to build a Panama Canal every fifteen days. The trend of such business was favorable, in diversity as well as in value. Our productive capacity is so great that overseas trade is the logical outcome; but competition must be faced abroad, and to meet this successfully necessitates the fullest utilization of mechanical devices in manufacturing and the highest degree of economy in distribution.

Europe Settling Down

Europe, as a whole, is settling down to business, stated Mr. Farrell; and, apart from the unemployment problem in Great Britain and the chaos in Russia, conditions are steadily improving there. A return to the former standard of buying power will be helped by the loaning of American money, a factor that has been responsible in no small measure for the excess of merchandise exports over imports in the foreign trade condition of the United States in recent years.

An optimistic viewpoint is justified, in Mr. Farrell's opinion. Occasional setbacks may be expected, but any prediction of continued misfortune will only adversely affect the outcome. Growth is inevitable in all countries, and this must mean increased buying power, the fruits of which will be shared by the United States.

Dean Howard T. Lewis, of the School of Commerce, University of Washington, speaking on the "Commercial Future of the Pacific Area," emphasized the essential nature of foreign trade in some commodities, and the need for the economical utilization or the conservation of our own resources of raw material. As a general rule it may be stated that food products sell themselves, but manufactured products have to be sold. Some essential raw material of importance to industry in general is found only in the Pacific area, and keen commercial rivalry is likely to develop in consequence.

The subject of "Selling America Abroad" was discussed by F. J. Koster, of the California Barrel Co., San Francisco, who maintained that world leadership now rests on the United States, Great Britain and Japan. Our potential productive capacity is sufficient to warrant an ambitious scheme for the development of foreign trade, but it should be recognized that the application of sound business principles is as essential abroad as at home.

At a lunch at the Ranier Club, at which H. F. Alexander, president of the Pacific Steamship Co. was host, B. C. Forbes, writer and financial journalist, urged the establishment of research laboratories for the solution of the problems confronting the smaller industries on the Pacific Coast, whereby new byproducts might be developed. He made a plea to the wealthy that they should invest some of their money thus for the good of the community.

At the afternoon session M. K. Singh, a native of India, stated that his country needed industrial not religious missionaries. The buying power is there, but a demand for American products can only be developed by tact and persistence. J. S. Martin, of the Remington Typewriter Co., discussed "Advertising" and outlined the history of his company's efforts in India and the resulting success.

Opportunity in India

G. E. Herrman, of the Vancouver Creosoting Works, Vancouver, B. C., speaking on "Modern Business Developments in India," discussed the governmental subsidy to the iron and steel industry in that country. Germany is obtaining a strong footing there, chiefly in hardware and metal goods such as sheet and galvanized iron. India has a favorable trade balance and there is opportunity for the exploitation of American goods. This viewpoint was also stressed by C. B. Spofford, U. S. Trade Commissioner at Bombay, who spoke on "Market Possibilities."

William H. Knox, of New York, stated that there was a demand in India for fine machine tools and mechanical equipment. British standard specifications are insisted upon, however, and American traders must recognize this fact. A tender was recently called for 5,000 electric fans. An American bid was satisfactory, but it failed to secure the order because of lack of personal representation. Other speakers believed that the protection of the Indian iron and steel industry would be beneficial for all concerned, leading to better wages and increased buying power for American manufactured goods.

F. R. Eldridge, chief of the Far East Division of the U. S. Bureau of Foreign and Domestic Commerce, speaking at a luncheon, pleaded for prompt delivery in China, which could only be secured by the maintenance of adequate stocks in hand here for immediate shipment. Permanent representation in China is also essential.

Julean Arnold, U. S. Commercial Attache in China, at another luncheon, drew attention to the effect of the introduction of a simpler written language in China, whereby about 1,000 characters are used instead of 30,000 or 40,000. Railways are the greatest need of that country today. T. Sakarauchi, manager of the Yokohama Specie Bank, Seattle, mentioned that the United States is Japan's best customer and urged the maintenance of good relations.

U. S. Needs Air Control

"Commercial Aviation" was the subject of the address, by Senator Hiram Bingham, who contrasted the success attending commercial transportation by air in Europe with the apathy that is shown toward the subject in the United States.

A system of government subsidies has helped commercial aviation in Europe, the adoption of which in this country would seem impracticable. The United States, however, is in urgent need of a Bureau of Civil Air Navigation, such as is established in European countries, for the regulation and inspection of equipment and personnel, and the avoidance of accident by adequate control measures. The Senator described in detail the recent development of the Ford Motor Co. in establishing a private service between Dearbon and Chicago.

The speech of the Hon. J. Butler Wright, Assistant Seretary of State, was in the main a defense of governmental methods in the diplomatic and consular service in their relation to American industry abroad.

Speaking at a luncheon of the American Manufacturers' Export Association, Gerard Swope, president of the General Electric Co., differentiated between a country that consumes 93 per cent of its production and exported 7 per cent, and one that consumed but 7 per cent and exported 93 per cent.

Increased participation on the part of United States manufacturers in the foreign field will cause competitors to take a lively interest in methods.

The immigration policy in the United States must inevitably mean an increased output per man. This has been achieved, mainly because of the fuller utilization of mechanical power. This fact will serve to emphasize the difference between American and European methods. Some electrical articles are now being sold for 11 per cent less than pre-war prices.

In the absence of Dr. H. Parker Willis, professor of banking at Columbia University, his paper on "Foreign Loans and Foreign Trade" was read by the secretary, O. K. Davis. After quoting statistics to indicate the immensity of loans made by the United States to foreign countries in recent years, Dr. Willis mentioned that the problem of the banker was to determine the credit rating of those who wanted to buy goods with the money sought, and the good faith of those who wanted funds. Bankers, however, should realize that the surplus at their command represents a surplus of goods, and that they have a national duty toward trade and commerce. Bank practice in regard to foreign loans has been considered in many quarters as very much of a mystery, but when viewed as a fundamental problem in the aggregate the matter is a simple one.

Greater co-operation between bankers and manufacturers is essential if a correct balance is to be maintained. Wise leadership and sound common sense are needed. However such loans are applied, increasing imports into the United States are inevitable, but the effect of this increase should be offset by greater exports.

Leave Mexico Alone

Mexico is a good place to leave alone until President Calles can rely on the assistance of an undivided cabinet. This was the opinion of D. E. Delgado, export sales manager for the Eastman Kodak Co. There is no assurance at any time that the labor faction in the government will not force the adoption of regulations that will cripple individual businesses.

General Calles is worthy of admiration, but he is powerless to follow the trend of his own inclinations toward progress and economy without support and assistance from within Mexico, particularly from within his own cabinet.

"Selling Methods" formed the subject of an address by A. P. Dye, U. S. Commercial Attache in Mexico City. He advocated the adoption of 75 per cent of the practices that have proved successful in this country. It is better, he said, to assume that merchandising conditions are the same and to be 25 per cent in error, than to assume that they are entirely different, and to be 75 per cent in error.

Speaking on "American Banking and World Rehabilitation," Henry M. Robinson, president of the First National Bank, Los Angeles, referred to the stabilization of currency in Great Britain and Germany as evidence of a significant advance. He characterized the action of the Federal Reserve System in aiding the Bank of England in the restoration of the gold standard in Great Britain as wise, courageous and far-seeing.

Mr. Robinson, in discussing the question of foreign loans, said that the subject should be treated entirely from the practical viewpoint, without consideration of the factors of humanitarianism or politics. German reparations payment and Allied debt settlement were considered in detail, and Mr. Robinson affirmed that as a result of the rehabilitation in Germany, that country would be in a postion to export large quantities of surplus goods in the near future.

China's foreign trade in 1924 broke all records, and the plan in view to increase customs duties will have a potent effect in restoring stability in that country, according to E. P. Thomas, president of the U. S. Steel Products Co. Lo Pa Hong, chairman of the delegates from the Chinese General Chamber of Commerce, Shanghai, speaking on "Modern Industrial Development in China," foresaw close co-operation between his country and the United States. He proposed the formation of an international banking syndicate, to foster reciprocity in business.

"Chinese-American Trade" was considered by Tse Tsok-Kai, manager of the Kwang-tung Electric Supply Co., Canton, who drew attention to the interest now being shown by Chinese business men in politics. He pleaded for a patient attitude toward China in her internal troubles. Julean Arnold, U. S. Commercial Attache at Peking, in discussing "Market Developments," surveyed the Chinese trade situation, and stated that whereas in 1890 there were only thirty-two American firms and 1,200 American citizens resident in the country, the number had risen to 600 and 12,000, respectively.

The session of "Canada" was preceded by an affirmation of the unity of purpose of the two great peoples of North America, and the absence of a line of demarcation between the countries other than in regard to the restrictions imposed by Customs authorities at the border restrictions which the chairman, Nathan Eckstein, president of the Schwabacher Bros. Co., of Seattle, hoped would be removed in course of time.

Dr. T. H. Boggs, in discussing "Branch Factories in Canada," sketched the industrial history of that country, with particular reference to the impetus given by the influx of foreign and British capital.

"Importers' Problems" were discussed by H. Blackwood, Deputy Collector of Customs, Seattle, who outlined custom-house practice and drew attention to the many recent changes in tariff laws.

At the closing session of the convention, Rear Admiral L. C. Palmer, president of the U. S. Fleet Corporation, mentioned that the reduction in warships to new ratios was throwing a greater responsibility on the merchant marine in times of emergency. Confining his remarks to ships engaged in the foreign trade, the admiral said that when he took over the presidency of the corporation the venture was suffering from "too much easy money." If the fleet could be operated under British conditions, the operator could just about "break even."

Admiral Palmer outlined a program to correct this condition.

The address on "The Merchant Marine," by C. W. Cook, chairman of the board of directors, American-Hawaiian Steamship Co., was read by proxy. The author pointed out that maritime nations do not subsidize cargo carriers. The practice is economically unsound and usually leads to retaliation. Various American industries are successfully operating their own boats, carrying lumber, oil, iron ore and other materials. Hasty and ill-considered legislation might nullify the advantages that might be gained. The granting of subsidies, in the opinion of the author, would result in a relapse to self-satisfied mediocrity in the coast trade and disappearance elsewhere. The White Star Line, with no aid, is more successful and pays more dividends than its subsidized rival.

Revenue Bureau to Appeal Decision in Case of the Oesterlein Machine Co.

Commissioner opposes publication of others' tax returns

While officials of the Internal Revenue Bureau are determined to carry the case to the United States Supreme Court, if necessary, they do not regard the decision of the District of Columbia Supreme Court ordering Commissioner D. H. Blair to produce records of tax returns of twelve machine tool manufacturers before the Board of Tax Appeals, which would have the effect of opening them to the public, as of such widespread importance as has been interpreted in some directions.

The decision was in a case involving excess profits taxes for 1918 and 1919 and revolves around Sections 327 and 328 of the revenue act of 1918. The cases now pending which might come within the same rule, if it is permitted to stand by higher courts, are comparatively few, it is said. Bureau officials also do not believe the same principle can be extended in other directions in tax litigation. However, because of the principle of secrecy surrounding tax returns which is involved, Commissioner Blair has served notice of appeal from the decision to the District of Columbia Court of Appeals and says he will carry it to the United States Supreme Court if necessary.

The decision was rendered June 29 by Justice A. A. Hoehling in the equity division of the District Supreme Court in a suit by the Oesterlein Machine Co., of Cincinnati, against Commissioner Blair and the Board of Tax Appeals to compel the commissioner to produce be-

fore the board information regarding tax returns by twelve other firms manufacturing machine tools for examination by the board of the method used by the bureau in determining excess profits taxes for 1918 and 1919.

The Oesterlein company is resisting a deficiency assessment against it for excess profits. It contends that as it was difficult to determine invested capital, which was a factor in arriving at excess profits, it should have been determined by the commissioner in relation to similar determinations for other corporations engaged in the same line of business, under Sections 327 and 328 of the revenue act of 1918, whereas the commissioner proceeded by other means. The case has been pending before the Board of Tax Appeals for nearly a year.

The board ordered the commissioner to produce the information regarding twelve other machine tool makers, named by the Oesterlein company. The commissioner refused, on the ground the information given him was confidential under the revised statutes. The Oesterlein company then carried the case into the courts, and the decision June 29 directs the commissioner to produce the data.

Information given before the Board of Tax Appeals is public property and the result of the production of this data of companies not concerned in the case would be to make details of their tax returns public.

The companies whose records are sought by the Oesterlein Machine Co. for comparisons are the Oliver Machinery Co., Grand Rapids, Ind.; the J. N. LaPointe Co., New London, Conn.; the Van Norman Machine Tool Co., Springfield, Mass.; the Ohio Machine Tool Co., Kenton, Ohio; the Willard Machine Tool Co., Covington, Ky.; the Carlton Machine Tool Co., Cincinnati; the Hoefer Manufacturing Co., Freeport, Ill.; Gould & Eberhardt, Newark, N. J.; the Garvin Machine Co., New York City; the John Steptoe Co., Cincinnati; the J. G. Blount Co., Everett, Mass., and the Greaves, Klussmann Tool Co., Cincinnati.

Best Methods of Training Foremen

Training foremen is the subject of a report just published by the Metropolitan Life Insurance Co. Few foremen appreciate what important factors they are in the lives of those whom they supervise. The report shows how foremen can make a day fruitful or barren.

The report deals with foremen as the key men or link between management and employees. Their part in reducing labor turnover, promoting and maintaining co-operation of men, cutting costs and eliminating waste is emphasized. There is much to be gained by training foremen to do these things says the report.

The report outlines subjects recognized as valuable for foremen training and gives a description of the best methods of teaching them. The foremen training practices of nine nationally known companies are described in quite some detail.

J. F. Schurch New President of Manning, Maxwell & Moore

At a meeting of the directors of Manning, Maxwell & Moore, manufacturers and distributors of railway and industrial equipment, held on July first, John F. Schurch, vice-president in charge of the Chicago branch of the firm, was elected president to succeed J. M. Davis, who resigned recently to become president of the Delaware, Lackawana & Western Railroad.

Mr. Schurch was graduated from the University of Minnesota in 1893. He entered the service of the Minneapolis, St. Paul & Sault Ste. Marie the same year, serving consecutively in the office of the auditor and of the general superintendent, and in the transportation department, resigning in 1905 after having attained the position of chief clerk to the vice-president. From 1905 until 1914 he was associated with the Railway Materials Co., of Chicago. In 1914 he was elected vice-president of the Damascus Brake Beam Co., with offices in Cleveland, and in the same year was elected president of the company, which position he resigned when he was elected vice-president in executive charge under president T. H. Symington, of the Symington Co. Mr. Schurch was president of the Railway Supply Manufacturers' Association. Mr. Schurch came to Manning, Maxwell & Moore in 1922, as a vice-president.

Machinery Exports for May

Exports of metal-working machinery for May, with revised comparative figures for May, 1924, as compiled by the Department of Commerce, are as follows:

	May, 1924	May, 1925
Lathes	$78,171	$283,923
Boring and drilling machines	62,879	41,344
Planers, shapers and slotters	29,303	33,010
Presses	46,571	50,448
Gear cutters	19,288	40,797
Milling machines	25,676	193,176
Threaders and screw machines	29,759	113,944
Punches and shears	3,171	38,686
Power hammers	16,950	9,983
Grinders	40,122	60,027
Chucks	22,981	32,797
Reamers, cutters and drills	179,761	231,223
Pneumatic tools	118,387	103,150
Foundry machinery	68,368	65,282
Other machine tools	324,878	479,530

Government Surplus Reaches Quarter Billion

Although figures for June 30 were not available, the United States Government began a new fiscal year on July first with a surplus for the year 1924-25 aggregating approximately $250,000,000. The actual surplus, as of June 29, was $248,865,186.

The Treasury, has appropriations and surplus amounting to $3,675,000,000 for maintenance of the government for the new fiscal year

The minimum surplus goal is placed by Treasury experts at $300,000,000 and they predict that it may be possible to pile up a surplus of $400,000,000 by June 30, 1926.

Tax collections up to June 27 were $1,775,430,000, compared with an estimate of $1,660,000,000, with a probable $3,000,000 to be received as of June 29 and 30.

Customs receipts for the year were approximately $548,000,000, which was $5,000,000 in excess of the year ending June 30, 1924; miscellaneous internal revenue, $828,500,000, compared with $948,894,000 for the preceding year, bringing total ordinary receipts to about $3,777,290,000. The estimated receipts were $3,601,968,000.

During the year the government collected $82,908,580 on foreign debts, most of which was from Great Britain.

Attorney General Seeks Rehearing of Trade Statistics Case

In announcing his intention to file petitions for rehearings in the Maple Flooring and Cement Manufacturers' Protective Association cases, the Attorney General made it clear that he is in no way challenging the principles laid down by the court, but simply is attempting to show that there was violation of law in these particular instances. The Attorney General's statement follows:

"Petitions for rehearing in these cases are in course of preparation and will be presented to the solicitor general within a few days. Leave was granted by the Supreme Court on June 8 to file such petitions within 30 days.

"The object of the petitions will not be to obtain a reconsideration of the principles of law enunciated by the Supreme Court in its recent decisions, but to point out that the evidence in these cases bring them within prior decisions of the Supreme Court, the authority of which has not been questioned. In other words, the Government will not take the position that the Supreme Court erred in holding that the mere collection and dissemination of trade statistics is in itself unlawful but will endeavor to point out that the evidence in the records shows that both the Maple Flooring Association and the Cement Association were co-operating in the use of such information for the purpose of maintaining prices.

"The whole effort will be to show that the evidence leads irresistibly to the conclusion that the defendants, through their associations, had agreed to maintain prices and otherwise restrain trade within the prior decisions of the Supreme Court in the Hardwood Lumber and Linseed Oil cases."

Use of Babbitt

The Department of Commerce announces total apparent consumption of babbitt metal, based on reports received from twenty-seven firms, as 5,081,667 lb. in May, as compared with 5,126,415 lb. in April. This consumption is calculated from sales by manufacture and consumption by those firms (among them several important railroad systems) who consume their own production.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE week ending with Independence Day, or "Defense Day" as it is now called, has been normally quiet in business. Sympathy with those who suffered by the earthquake at Santa Barbara is general and the event may have had a restraining influence, although dulness at this time of the year is normal.

The drop in French francs to 4.45 and the sympathetic decline in Italian lira as well as Belgian francs was the only financial happening that may be regarded as sensational. It is perhaps a logical consequence of the increase of six billion francs in the paper currency of France that has been decided upon by the Caillaux administration. There are some who think that the issue of the internal "gold parity bonds" concurrently authorized may make it possible for the French treasury to tide over the present emergency, but others doubt this and pending some definite affirmation of the world's confidence in French credit the outlook is at least dubious.

But America has only an academic and sentimental interest in the fiscal problems by which France is confronted and it cannot be said that the vagaries of the franc have had any direct influence upon the markets of this country.

In so far as the stock market is concerned the aggressiveness of those who are trying to revive stock speculation was somewhat checked by the 6 per cent rate for money established early in the week. But it soon came to be understood that the advance was the result of the necessity of assembling the funds that would be required to meet the large interest and dividend payments due on the first of July, and when this money is redistributed lower rates are expected.

The weekly statement of the Federal Reserve System issued July 2 probably reflects this distribution, for it shows a decline of 2.1 per cent in the reserve ratio, a loss of $25,000,000 gold and an increase of $93,000,000 in earning assets.

But even with cheaper money it seems to be doubtful whether the public can be induced to re-enter the market on an important scale. As stated last week, brokers' loans are already at or near the maximum and the prevailing feeling even among the brokers themselves is against any further increase at the moment. There is an expectation that when the crops commence to move there will be an increased demand for commercial accommodation that will make the banks unwilling to lend freely against stocks and bonds, and this expectation makes for conservatism among those who are already borrowing heavily on collateral.

The failure of the New York stock brokerage firm of Dean Onativia & Co., has perhaps increased this conservatism, but it is not as important as it would appear from the liabilities, which are estimated at from 30 to 35 millions. Most of this money was borrowed on collateral which is presumably marketable and the loans will be liquidated by its sale. But the effect upon public sentiment will be dampening nevertheless and it may retard the improvement in business that so many expect.

The decline in wheat and corn, which have been steadily drooping for nearly two weeks, is making merchants in the Middle West a little more cautious, but this is about the only development that has had the slightest effect upon the widespread confidence in the future hitherto expressed.

Cotton was firm early in the week but a decline of nearly a cent followed the publication of the government report issued on Thursday, which report was none too encouraging.

The steel industry and the business in non-ferrous metals show but little change. The consumption of copper is enormous, but the production has been equal to the demand and it is to be inferred that the larger producers are satisfied with the profits they are making at present prices. From the west an increase of building activity is reported and the reconstruction made necessary by the earthquake at Santa Barbara will no doubt quicken the demand for lumber on the Pacific Coast.

A seasonal coal strike appears to threaten, but it attracts less attention than usual because there is a suspicion that these summer strikes are organized to quicken a lethargic demand for coal.

The automobile industry, now almost completely concentrated in the hands of about nine or ten big companies, is said to be in a more satisfactory condition than for some time. Rumors that General Motors will absorb the various yellow cab and motor bus lines controlled by the Hertz interests have revived interest in the case of the motor bus versus the railway, and it is now suggested that these two agencies of transportation will be coordinated to their mutual advantage if General Motors is successful in carrying out the plans attributed to it.

Each day brings us nearer to the next session of Congress and as an excuse for inaction is welcome to most men they may have a restraining effect upon capitalists until they are disposed of.

This possibility, in conjunction with the parlous financial condition of the French government, are the only two adverse factors in a situation that is otherwise satisfactory. But their effect, if it is felt at all, will be chiefly apparent in the financial markets, and there is nothing in sight that seems likely to restrict the business of those merchants and manufacturers who are engaged in supplying the prosperous masses of the United States with the necessaries and luxuries that they are so well able to buy.

What's Doing in Industry

The machine tool and machinery market continues active despite the customary summer slowing up of industrial activity. The automotive field, working at forced pressure to fill current demands, has supplied a genuine increase in business for manufacturers and dealers in mechanical equipment of all kinds.

The Mid-West, because of its automotive supremacy, enjoys the greatest activity. Chicago reports a decided improvement in the demand for machinery, the first six months of this year surpassing the same period of last year. Cincinnati dealers report more inquiries than at any time this year, with orders coming from practically every section of the country. The center of activity, Detroit, continues at full capacity and motor manufacturers are seeking machinery to increase production without the necessity of adding more labor or working shifts.

The South remains quiet, with industrial buyers the only possible prospects for future orders. Philadelphia reports new inquiries but few new orders. The New England district holds out hopes for a pick up in business during the coming months, export trade looming as the best source of new orders.

The general business situation is normal for this time of the year. The slight difficulties in foreign financial developments have not had a deterrent effect on domestic business, and government reports indicate a condition of prosperity all over the country.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

A decided improvement in the machine tool industry is noticeable in practically every department of the business. To some extent, this is attributable to a fairly general distribution of railroad orders, but apart from that feature the market for machine tools and special machinery indicates a distinct upward trend. This has given rise to a feeling of optimism among dealers, who now venture the opinion that the curve of the business has changed its direction.

An officer of one of the largest machine tool concerns in this territory reports his company's sales for June of this year exceeded those for the same month every year since 1920. Another prominent dealer expressed himself as well pleased with conditions and prospects, prophesying a gradual improvement in all machinery lines.

Manufacturers of gears and gear cutting machinery report business as active in their special department of production. An official of one of the largest concerns of this kind in Chicago reported that the six months ending June 30 showed an increase of 30 per cent over the same period in 1924. The automotive industry was the heaviest buyer.

Several representatives of local machinery interests journeyed to Dayton, Ohio, last week to attend the sale of the Recording and Computing Machine Co. Some bought rather extensively, either to add to the equipment of their own plants, or for re-sale. A sale of machine tools and machinery was held in Chicago on June 29 when the entire equipment of the Robertson Bros. Manufacturing Co., manufacturers of sheet metal products, was disposed of. Among the articles disposed of were 18 punch presses, 25 toggle presses, 200 lathes, 36 drill presses, several motors and a quantity of small tools.

Cincinnati

Machine tool manufacturers in the Cincinnati district report a slight increase in orders during the past week, together with a good volume of inquiries. In a few cases it has been necessary to add employees to factory forces in order to fill immediate orders. There is plenty of skilled labor available, and therefore it is not difficult to increase production.

A feature of the market is the unexpected opening up of the Chicago territory, from which several good-sized orders are reported to have been received during the past few days. Some predict a similar opening up of other territories, these forecasts being based on reports of improvement in general business.

The common feeling among manufacturers is that the machine tool market is taking on a better tone in all sections. Inquiries are coming in from all parts of the country, and buying is evenly spread. Retailers and selling agents report that there have been a larger number of out-of-town buyers in the city the past few days than usual, and for this reason this branch of the trade feels much encouraged.

The greatest volume of buying during the week has been from the automotive industries, which have sent in some fairly large orders, with inquiries which indicate further needs. Railroad buying is reported to have increased somewhat, but orders from this source are neither numerous nor large. A slight increase in export orders is reported, and the prospects in this field are regarded as very satisfactory.

Philadelphia

There was little to indicate any radical change in the machinery and machine tool business in Philadelphia last week. One of the largest manufacturers said that a few inquiries were being received from various sources, but there has been little manifestation that these inquiries will result in substantial buying in the near future.

The Pennsylvania Railroad is not anticipating any purchases other than current needs, and these are being kept down in conformity to the company's retrenchment policy.

An officer of one of the Philadelphia companies specializing in the manufacture and designing of tools for locomotive engines, stated that the whole situation has been quiet, but from inquiries being received there is a possibility of some buying in the near future.

Southern District

Machine tool, machinery and mill supply sales all seem to have quieted down a little the past two weeks. Most dealers, however, report a volume still exceeding the corresponding period of last year by about 8 to 10 per cent. With but one exception larger distributors agree that the late summer and fall outlook is good, and that business will run ahead of the same period last year. Mill supply business is expected to be particularly good.

The outlook for the immediate future is also promising, as inquiries the past ten days have improved. Many of these inquiries are for machine tool equipment including lathes, drill presses and grinding machines. July gives promise of running better than last year.

Sales to service stations have fallen off. Smaller machine shops are reported buying a little more freely. The textile business has quieted down a little, but the late summer and fall outlook appears satisfactory because of the large amount of new textile mill construction now in progress.

Railroads are still inquiring for heavier equipment, but buying a little less than they were.

Sales to road building contractors and state highway departments throughout the South continue fairly good, and will probably do so for the next two or three months.

Milwaukee

Beneath a quiet surface there seems to be considerable activity in the trade in metal-working equipment, although it cannot be said that conditions are yet normal. In most instances users of tools are seeking greater efficiency rather than greater capacity, with the result that the volume of business is not large, and sales usually do not go beyond one or two items at a time.

No large lists are before the trade, and there are no outstanding requirements in immediate prospect. The opinion among makers, as well as dealers, seems to be growing more cheerful, however, and while not much definite improvement in business is looked for during the remainder of the summer, an active fall and winter demand is expected.

June volume just about held its own with May, but this is considered significant of a check upon the slowing-up tendency that metal-working equipment business had been undergoing. The improvement is ascribed mainly to the activities of automobile manufacturers. This embraces the industries manufacturing parts, materials and equipment for both automobile and motor truck makers. The foundries supplying the motor trade have been able to operate at the best rate reached in nearly a year's time.

In the farm machinery business, the condition is spotty. Some of the larger producers have been rushed with orders, while others complain of a lagging demand. This industry has bought little equipment in the past week.

Receivers of the Chicago, Milwaukee & St. Paul Railway have purchased some much needed machinery for the West Milwaukee car and locomotive shops, the largest of the system. Inasmuch as this system has added little new equipment for a long time the present buying gives the tool market at least a semblance of activity in the railroad field. The policy of the Chicago & North Western line, as indicated by the rate of activity in its shops in various Wisconsin terminals and division points, is one of retrenchment that

gives little promise of new business outside of barest necessities of a replacement character.

Industrial activity is quiet. The policy of purchasing only for immediate needs has naturally been reflected in manufacturing. While most manufacturers are fairly busy, they are without the mass of future orders that in past years at midsummer served to make predictions as to future business optimistic.

New England

Business in the machinery industry in the Connecticut section of New England during June showed a fair increase over May, and the first half of 1925 showed improvement of from 10 to 25 per cent over the volume for the corresponding period of 1924. The sentiment of manufacturers is that business in the second half of the year will show more improvement, although seasonal dullness in August may be expected.

A few manufacturers report increases in their working forces ranging from 5 to 10 per cent. Hand-to-mouth buying continues. Orders are small, but they are coming with more frequency. Demand for screw machinery for the radio industry has made an early start.

There is a feeling that German competition is making itself apparent in the export business, and a decrease in this business was mentioned in several places. Another reason attributed to the falling off of export business was the financial condition of several of the European countries.

Detroit

Upon the decision of a few of the larger motor car manufacturers as to whether they will add other shifts and use present equipment, or whether they will speed up present equipment to meet the public demand for automobiles, depends the volume of sales of machinery and machine tools in the Detroit territory during the next two months. There is an apparent slackening up in inquiries just at present, and in the opinion of several leaders a further slowing down may be expected during July and August.

Three examples will illustrate the condition so prevalent in Detroit just at present.

Dodge Brothers, whose sales staff is calling for a production of some 1,500 cars a day, is tooled up for only about 1,000 cars daily. The addition of another shift and retention of present machinery and equipment will save the new owners several millions which would otherwise have to be placed in new buildings, machinery and tools. As a logical sequence, machinery installed to manufacture 1,000 cars a day cannot be expected to last as long when speeded up to a 1,500 daily production.

While the Ford Motor Co. is the largest single buyer of machinery and machine tools in Detroit, the automobile end of the business is not as productive of large orders for machinery representatives in Detroit as was true some weeks ago. Three shifts a day, instead of two, would enable Ford to turn out 10,000 cars instead of the 7,000 of today. Such a move, unless accompanied by wholesale purchases of new equipment, would mean the abandonment of present machines that much sooner.

At present the Packard Motor Car Co. is buying more machinery and tools than any other concern. Millions are being spent in the plant for additions, extensions, new machinery and tools. All current is being changed over from d.c. to a.c. Miles of copper wire are being torn up, and every new piece of machinery being purchased is motor driven with the exception of some equipment used in toolrooms. For years Packard bought machinery by leaps and bounds, picking up a new machine here and another there. A complete reversal of policy, due, it is contended, to a favorable balance sheet and a contemplated reduction in price, has taken place, with the net result that the entire plant will be thoroughly modernized to the last detail.

Ford is expanding the department where steam turbines are being built for use in the Ford plants throughout the world. One leading machinery representative recently installed some new milling machines, lathes, boring machines and other equipment in the steam turbine department, which will mean doing away with the double-end boilers now in use at the Ford plants in Detroit.

The report of the Employers' Association for this week shows employment in the automobile and accessory plants to be above the 240,000 mark for the first time in more than twelve months.

Southern Pacific Gets Permission to Buy Equipment

Authority has been granted by the Interstate Commerce Commission to the Southern Pacific Railway Co. to assume obligation for equipment trust certificates to the extent of $10,491,000, which sum will be applied to the purchase of $15,000,000 worth of equipment as follows: 15 three-cylinder steam locomotives at $80,901 each; 18 mountain-type steam locomotives at $79,500 each; 10 switching steam locomotives at $36,623 each; 2,796 steel underframe box cars at $2,358 each; 200 steel underframe auto box cars at $2,762 each; 1,000 steel gondola cars at $2,054 each; 200 tank cars at $2,302 each; 400 ballast cars, Hart type, at $2,060 each; 70 caboose cars at $3,128 each; 6 combination baggage and mail cars at $24,971 each; 6 steel baggage and horse cars at $23,659 each; one dynamometer car at $63,500; one rotary snow plow at $44,000; one 50-ton locomotive crane at $17,600; one 25-ton locomotive crane at $15,316; one 25-ton locomotive crane at $11,509; one industrial No. 3 pile driver at $30,475; 2 industrial No. 4 pile drivers at $26,575 each; 3 Jordan spreaders at $15,500 each; 6 electric motor coaches at $40,000 each.

Machine Tool Plants Active in 1923

In 1923 twenty-two plants engaged in the manufacture of machine tools operated at 54.8 per cent of capacity, according to the Census of Manufacturers. The 1921 census showed that the same plants in that year were operated at only 23.2 per cent of maximum capacity. One hundred and eighty screw machine plants operated at 67.5 per cent of capacity as compared with 34.8 per cent in 1921. Similar figures covering the output of other products follow:

	Number of Plants	1923	1921
Wood Screws	10	86.6	56.8
Saws	80	72.6	38.8
Cash registers	37	85.7	64.
Foundry and machine shop products	8,531	69.8	44.6
Motor vehicles	351	74.9	43.1
Motor cycles	39	65.7	34.4
Sewing machines	40	67.	49.8
Textile machinery	428	74.2	72.3
Agricultural implements	312	61.1	35.4

Simonds Awards for Economics Essay

Announcement has just been made of the awarding of the cash prizes to the winners of the essay contest conducted throughout the country through the generosity of Alvan T. Simonds, president of the Simonds Saw and Steel Co. of Fitchburg, Mass. Mr. Simonds, an enthusiastic student of economics, has each year offered prizes amounting to $1,500 for the best compositions on a given phase of economics.

The subject for this year's essay was "Sharing Our National Income," and was won by Aaron Scherwin, of Brooklyn, N. Y. The judges were Dr. Albert Shaw, editor of the *Review of Reviews;* George W. Coleman, of Babson Institute; and John G. Thompson, of Fitchburg.

The prize contest for 1925 has as its subject "Your Prosperity and Mine," and is open to anyone in the United States and Canada.

Machinist Wins Scholarship Abroad

The first labor union scholarships ever exchanged officially between America and Europe will begin October first.

Spencer Miller, jr., executive secretary of the Workers' Education Bureau, official organization of the American Federation of Labor, has announced approval of plans whereby William Ross, machinist, of Baltimore, Md., will go to Ruskin college, Oxford, England, and Horst Berenz, woodturner, will come from the Free City of Dantzig to attend Brookwood Labor College, at Katonah, N. Y.

The scholars arrange for their own traveling expenses under the terms of the exchange. Their tuition and living costs, however, are borne by the institution, acting as host. Ross's trip will be financed by the machinists' union of Baltimore. Berenz will be sent by his woodturners' craft in Dantzig.

Business Items

The Page & Ludwick Co. has been organized in Chicago by F. J. Page, formerly of the Milwaukee Electric Crane and Manufacturing Co., and R. E. Ludwick, formerly of the Whiting Corporation, of Harvey, Ill. Offices have been established at 14 East Jackson Blvd., in Chicago. The firm will represent the Milwaukee Electric Crane and Manufacturing Co. besides handling the lines of several other concerns.

The Giddings & Lewis Machine Tool Co., of Fond du Lac, Wis., announces the establishment of an apprenticeship system in its foundry and heat-treating plants. The former will require a three year course of study, while the latter will require four years.

The Chrysler Motor Co. announces the removal of its service department from Newcastle, Ind., to Dayton, Ohio. The change was made to permit more room for the drop forge and screw machine departments in the Newcastle plant.

The Simmons Machine Tool Corporation, of Buffalo, N. Y., has purchased the assets of the Herschell-Spillman Co. in that city. The service and replacement departments will be carried on by the Simmons organization.

The Curley-Nelson Co., Inc., has been established at Kearny, N. J., to manufacture tools and machinery. Incorporators named are Gustave Nelson, William E. Curley and Henry Carless.

The L. W. F. Engineering Co.'s plant at College Point, N. Y., was sold at auction on June 30. The factory was built during the war for the manufacture of airplanes and contained a quantity of modern machine tools and equipment.

The Fostoria Pressed Steel Co., of Fostoria, Ohio, has purchased the plant of the Ashland Manufacturing Co., at Ashland, Ohio, and will move the organization to the main location of the company in Fostoria.

The Strom Ball Bearing Manufacturing Co., of Chicago, announces the appointment of Frank R. Schubert as general manager. John Diesk succeeds Mr. Schubert as works manager and Lorenz Peterson is assistant works manager in charge of production.

The Metal Ball Co., of Danbury, Conn., controlled by the Rolling Steel Corporation, announces that the plant formerly occupied by the Borden Condensed Milk Co., at Brewster, N. Y., has been acquired and will be used for the manufacture of steel tubing. The company's warehouse will be removed from Hoboken, N. J., to Brewster.

Personals

August H. Tuechter, president of the Cincinnati-Bickford Tool Co., Cincinnati, will celebrate the 40th anniversary of his entrance into the machine tool industry on Monday, July 13. He has had the pleasure, accorded to few, of growing with the company in which he started to a commanding and respected position in the community and in the industry.

Frank A. Scott, of Cleveland, president of the Warner & Swasey Co., has been awarded a certificate by the war department for notable service in connection with the procurement of supplies during the World War. The certificate was conferred by Acting Secretary Dwight Davis at the graduating exercises of the Army School. Colonel Scott was chairman of the general munitions board and was first chairman of the War Industries Board. He is now chief of the Cleveland District Ordnance Office.

Frank P. Cox, manager of the West Lynn Works of the General Electric Co., has been elected a director of the American Management Association. He will be in charge of the association's production executives division.

Harry Craig, of the H. S. Gray Co., of Honolulu, dealer in machine tools, has been visiting the machinery markets in the United States.

James Blair, secretary and assistant treasurer of the Niles Tool Works, Hamilton, Ohio, has resigned. Mr. Blair was associated with this company for forty-two years.

Dr. William Von Opel, one of the largest manufacturers of automobiles in Germany, sailed for home on June 30 after spending a few weeks in the American market selecting machinery and equipment for his plants in Germany.

Fred Erb, manager of the foundry of the Packard Motor Car Co., in Detroit, has resigned. Mr. Erb is a former president of the Detroit Foundrymen's Association.

P. D. Carr, formerly connected with the sales department of the Cincinnati Planer Co., Cincinnati, Ohio, but who recently joined the selling force of the Motch & Merryweather Co., Pittsburgh, has withdrawn from the machine-tool business and entered the radio field. He is now with the Barringer Radio Sales Co., Cincinnati, in charge of sales promotion.

George Ford, who was general manager of the foundry department of the Stoughton (Wis.) plant of the Moline Plow Co., has leased the foundry department for five years, with an option to purchase, and is organizing a corporation to conduct the plant as a commercial casting plant for custom work. The Stoughton plant recently was acquired in its entirety by the city of Stoughton from the proceeds of a $100,000 bond issue, and several departmental buildings already have been sold or leased to outside concerns.

Obituaries

Justus I. Wakelee, president of the Sedgwick Machine Co., of New York, died suddenly at Egypt Mills, Pa., on June 26. He was 58 years old.

J. Harvey Finch, of Greenwich, Conn., a director of the Sweet Steel Co., of Williamsport, Pa., died in New York City on July 2. He was 48 years old.

Emil Guggenheimer, a director of the Augsburg-Nuernberg Printing Machinery Co., of Berlin, Germany, died June 29 at the age of 65. Mr. Guggenheimer was well known in engineering circles both here and abroad, and was one of the chief advisors of Dr. Walter Rathenau during the reparations negotiations.

John W. Reid, Jr., president of the Belle City Manufacturing Co., Racine, Wis., manufacturer of threshing machinery, agricultural implements and tools, died June 27 after a prolonged illness. He was 47 years old. Mr. Reid went to Racine in 1912 to become associated with the J. I. Case Threshing Machine Company.

Albert D. Dorman, president of the Steel Sales Corporation, the Chicago Pulley and Shafting Co., and the B. F. Gump Co., died June 27 following an operation. Mr. Dorman was active in several Chicago industrial enterprises. He was member of the Machinery Club of Chicago.

Trade Catalogs

Diesel Engines. Fairbanks, Morse & Co., Chicago, Ill. Modern Methods in Diesel Engine Building is the title of Bulletin No. 1040 just published by Fairbanks, Morse & Co. The bulletin, large and attractively designed, contains an interesting and complete survey of the manufacture of stationary and marine Diesel engines.

Turret Lathes. The Foster Machine Co., Elkhart, Ind., is preparing a series of production stories and photographs showing the actual performances of its turret lathes and chucks. The first of these, in a loose-leaf folder, has been issued, and others, to be inserted in the folder, are soon to follow.

Presses and Shears. Niagara Machine & Tool Works, Buffalo, N. Y. Circular No. 215 describes in condensed form several models of punching and trimming presses and shears, and contains illustrations of each.

Refrigeration Motors. Century Electric Co., St. Louis, Mo. A short description of the Century motors and plant is contained in Form No. 573, now being distributed.

Automatic Screw Machines. The Cleveland Automatic Machine Co., Cleveland, Ohio. The specifications and details of the 1¼-in. and 2-in. model M "Cleveland" four-spindle automatic are listed in Treatise No. 7 now being circulated.

Pulley Grinders. The Graham Manufacturing Co., Providence, R. I. The Graham pulley grinder is the subject of Circular F which gives a full and thorough description of the machine and its uses.

Taps, Dies and Small Tools. The Threadwell Tool Co., Greenfield, Mass. Catalog No. 4, canceling all previous editions, has been issued. A full line of screw-plate outfits, taps, dies, counterbores, reamers and keyway sets is described. Tables show the dimensions and tolerances for several tap standards, basic thread dimensions and weights per foot of bar iron. The catalog contains 88 pages 5 x 8 inches.

Pamphlets Received

Fifty Questions and Answers about Power-Factor. Published by the Wagner Electric Corporation, St. Louis, Mo., telling in a concise and direct way what is meant by the term power-factor and how it is used. The definition of the term is brought out by the questions in the first chapter, while the subsequent chapters show the importance of the magnetizing current, its cost and control.

Simplified Practice for Sheet Steel. Published by the Bureau of Standards, Washington, D. C. Elimination of Waste, paper No. 28. Contains the schedule for simplified sizes and weights of sheet steel as adopted unanimously on Oct. 1, 1924, by the general conference of representatives of manufacturers, distributors, and consumers of sheet steel.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition, Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; G. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Prices show little tendency to go lower in the current iron market, although buying is confined to small tonnage lots. The steel items showing greatest price firmness are bars, tin plates, wrought steel and cast-iron pipe. Quotations on the principal heavy-rolled products are about the same as a week ago. Bars are $2 per 100 lb.; shapes, $1.80 to $2 and plates, $1.80 to $1.90 at Pittsburgh mills.

Non-Ferrous Materials—With the possible exception of lead, all non-ferrous metals showed improvement in demand during the first week in July. Tin while firmer in the domestic market was slower abroad. Wiping cloths are down about ¼c. per lb. and raw linseed oil is selling at $1.01 per gal. (5 bbl. lots) f.o.b., New York, against $1.07 on June 30.

(All prices as of July 3)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	19.00@22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.10	3.50
No. 12	2.30@2.35	3.94	3.15	3.55
No. 14	2.35@2.40	3.99	3.20	3.65
No. 16	2.45@2.50	4.09	3.35	3.80
Black				
Nos. 17 to 21	2.90@3.00	4.15	3.90	3.80
Nos. 22 to 24	2.95@3.05	4.20	3.95	3.85
Nos. 25 and 26	3.00@3.10	4.25	4.00	3.90
No. 28	3.10@3.20	4.35	4.10	4.00
Galvanized				
Nos. 10 and 11	3.15@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.25@3.35	4.45	4.20	4.10
No. 16	3.40@3.50	4.60	4.35	....
Nos. 17 to 21	3.55@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.85@3.95	5.05	4.80	4.70
No. 28	4.15@4.25	5.35	5.10	5.00

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	....	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.80
Cold drawn flats, squares	4.65	4.30	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¾c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.25
Tin, 5-ton lots, New York			58.12½
Lead (up to carlots) E. St. Louis	7.70	New York	8.40
Zinc (up to carlots) E. St. Louis	7.05	New York	7.87½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.50	19.00	....
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	16.00	20.00
Copper bars, base	20.87½	20.75	22.50
Copper tubing, base	23.75	24.75	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.25	11.25	11.37
Solder (½ and ½), (case lots)	39.50	36.50	.....
Babbitt metal (83% tin)	60.00	65.00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50 60

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	11.25
Copper, heavy, and wire	10.75@11.00	11.00	10.75
Copper, light, and bottoms	9.25@ 9.75	9.00	9.25
Heavy lead	6.00@ 6.25	6.25	6.25
Tea lead	5.00@ 5.25	3.75	4.50
Brass, heavy, yellow	6.75@ 7.25	6.50	6.75
Brass, heavy, red	8.50@ 8.75	8.75	8.75
Brass, light	5.75@ 6.00	5.50	5.75
No. 1 yellow rod turnings	7.25@ 7.50	7.00	7.25
Zinc	4.00@ 4.25	3.50	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.00
"A" Grade:				
IC,	14x20	8.85	9.40	8.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14
Cotton waste, colored, per lb.	.10@ .15½	.18	.09½
Wiping cloths, 13¼x13¼, per lb	.17@.17½	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	...	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.60	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.01	1.24	1.23
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0334
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1587½	.1587½	.14
Solder (½ and ½)	per lb.	.395	.395	.3375
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	30–10%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$5.00
Emery paper	10.71	11.00	11.00
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.50
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	...	.65	.75
Coke, prompt furnace, Connellsville	per net ton		2.85@3.00
Coke, prompt foundry, Connellsville	per net ton		3.75@4.25
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x⅝in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for ⅛-in. and smaller and 65% for ¼-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x 2 1/16-in. to 4 1/16-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, 1/16x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Birmingham—J. L. Williams, 3028 4th Ave.—stamping machine for stamping out 30 gage, 30 x 30 in. and 14 x 20 in. metal signs.

Calif.—State has appropriated $3,000 for purchase of shop machinery and equipment for State School at Preston. B. G. McDougall, Forum Bldg., Sacramento, State Archt.

Calif., Bakersfield—Bd. of Education, W. F. Witaker, Secy.—one 6 in. motor driven jointer and planer mounted on column.

Me., Brewer—School Committee—metal working machinery for manual training department of new high school.

Mass., Dorchester (Boston P. O.)—W. Wexler, 50 Theodore St.—repair tools and equipment for service garage.

Mass., East Cambridge (Boston P. O.)—Box 22—arbor press with gap about 16 in. and 10 in. radius.

Mass., Malden (Boston P. O.)—William D. Arnold Co., 17 Center St.—No. 4 vertical Becker miller.

Mass., Roxbury (Boston P. O.)—J. H. Dalton, 9 Reed St.—miscellaneous tools and equipment for entensive repair and service garage.

Mass., South Boston (Boston P. O.)—P. H. Rafferty, 771 East Broadway—repair tools and equipment for service garage.

Mich., Detroit—Dept. of Street Railways, 111 Administration Bldg., St. Jean and Shoemaker Aves., F. Meyer, Jr., Pur. Agt.—144 ⅞-in. and 288 1 1/16-in. square tapered shank flat track drills.

Mich., Detroit—M. R. Hauk, 3349 14th Ave.—angle bender for bending ½ in. stock cold.

Mich., Detroit—Hudson Motor Car Co., 12601 East Jefferson Ave.—89 ft. span crane and craneway, press shop equipment.

O., Findlay—The Welding Co., P. O. Box 466—electric arc welding machine.

Wis., Beloit — Beloit Foundry Co., 308 Gardner St.—foundry equipment.

Wis., Wausau—Morgan Bros., 402 2nd St. (garage)—grinder, lathe, air compressor.

Wis., Wausau—Northern Machine Works c/o G. Stolze, 308 7th St.—sheet metal working machinery, foundry equipment.

N. S., Tusket—L. S. Floyd—portable type shingle and lathe machine.

Ont., Dundas — W. H. Whittle, Matilda St.—equipment for repair shop including oxy-acetylene welding outfit to replace fire loss.

Que., Labelle—R. L. Villeneuve—(lumber, pulp wood, etc.)—sawmill machinery.

Que., Matane—L. Labrie—rip saws and other sawmill machinery.

Que., Montreal—U. H. Dandurand, 101 Notre Dame St. W.—complete machinery and equipment for 5 story repair garage.

Opportunities for Future Business

Ala., Anniston—M. H. Valve & Fitting Co., J. W. Conway, Pres., plans the construction of a 100 x 500 ft. foundry building and a 30 x 75 ft. pattern shop. J. E. Sirrine & Co., 309 South Main St., Greenville, S. C., Engr. Noted May 21.

Calif., Los Angeles—Bd. of Education, is receiving bids until July 10 for the construction of a main classroom building, and shop for Burroughs Jr. High School. Estimated cost $150,000. F. J. Catton, 2614½ West 7th St., Archt. Noted June 18.

Calif., Los Angeles—E. C. and E. W. Taylor, 713 West 8th St., Archts., is receiving bids for the construction of a 3 story, 97 x 250 ft. showroom, garage and repair shop at 21st and Figueroa Sts. for W. E. Bush Co., 1701 South Grand St.

Calif., San Francisco—Pacific Rolling Mill, 17th and Mississippi Sts., plans the construction of a 1 story steel mill, 2,000 tons per month capacity, at Marin and Kansas Sts. Estimated cost $750,000.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Calif., San Francisco—U. S. Metal Products Co., 330 10th St., plans the construction of a 2 story, 208 x 416 ft. plant at 3rd and Williams Aves. Architect not selected.

Conn., New Haven—E. M. Jennings Co., 347 Crown St., will receive bids until July 10th for the construction of a 1 story, 100 x 280 ft. garage, service and showroom on Whalley Ave. Estimated cost $100,000. Norton & Townsend, 839 Chapel St., Archts.

Fla., Jacksonville—The American Cross Arm Co., Graham Bldg., has acquired a 20,000 acre site in Orange & Osceola Counties and plans the construction of a 100,000 ft. daily capacity lumber plant including dry kiln and planing mill.

La., Shreveport—Texas & Pacific Ry. Co., 120 Broadway, New York, E. F. Mitchell, Dallas, Tex., Ch. Engr., will soon receive bids for the construction of a roundhouse, repair shops, etc. Estimated cost $200,000.

Mass., Boston—Dedham & Hyde Park Gas & Electric Co., 1242 River St., Hyde Park, is having preliminary plans prepared for the construction of a 1 story garage and repair shop on River St., here. Estimated cost $40,000. W. D. Brown, 45 Milk St., Archt.

Mass., Chelsea (Boston P. O.)—Francis & Badger Motor Co., 297 Broadway, plans the construction of a 1 story repair and service garage on Broadway. Estimated cost $50,000. H. F. Kellog, 110 Summer St., Boston, Archt.

Mass., Dorchester (Boston P. O.)—James Russell Boiler Works, 9 Dewar St., will soon receive bids for the construction of a 1 story addition to plant. Estimated cost $40,000. Monks & Johnson, 99 Chauncy St., Engrs.

Mass., Lowell—T. E. Parker, 142 Chestnut St., is receiving bids for the construction of a 1 story repair and service garage on East Merrimac St. Estimated cost $50,000. Coolidge & Carlson, 89 State St., Boston, Archts.

Mass., Sommerville (Boston P. O.)—Ford Motor Co., Highland Park, Mich., (Detroit P. O.) will receive bids about July 10th for the construction of a 300 x 1160 ft. assembling plant on Middlesex Ave., East Sommerville. Estimated cost $4,000,000. A. Kahn, Inc., Marquette Bldg., Detroit, Mich., Archt.

Mass., Willimantic (Holyoke P. O.)—B. F. Perkins & Son, Inc., Holyoke, will soon receive bids for the construction of a 2 story, 80 x 150 ft. manufacturing building and one story 80 x 260 ft. machine shop. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Mich., Detroit—Hudson Motor Car Co., 12601 East Jefferson Ave., will soon award contract for the construction of a 3 story, 84 x 580 ft. addition to press shop at Connors & Knodnell Aves. A. Kahn, 1000 Marquette Bldg., Archt.

Mich., Detroit — D. Nederlander, 11 Campus Martius, plans the construction of a 4 story, 100 x 100 ft. garage on Woodward Ave. Estimated cost $150,000. C. H. Crane, 542 Griswold St., Archt.

Mo., Kansas City—E. M. Crago, c/o Crago Gear & Machine Works, 1416 Walnut St., plans the construction of a 3 story, 66 x 100 ft. gear and machine plant at 615 East 17th St. Estimated cost $50,000. Architect not selected.

Mo., St. Louis—Busch Selzer Bros. Diesel Engine Co., 3300 South 2nd St., awarded contract for the construction of a 1 story, 28 x 46 ft. foundry building. Estimated cost $40,000.

O., Cleveland—Ferro Enameling Co., C. M. Horn, Secy, 4150 East 56th St., awarded contract for the construction of a 2 story, 23 x 54 ft. addition to enameling room at 4150 East 56th St. Estimated cost $40,000.

Wis., Beloit — Beloit Foundry Co., 308 Gardner St., is receiving bids for the construction of a 1 story, 84 x 180 ft. foundry building. Private plans.

Wis., Milwaukee—Dept. Public Works, R. E. Stoelting, Comr., will receive bids until July 15th for the construction of a 1 story, 120 x 460 ft. repair and service plant on Canal St. Estimated cost $150,000. C. E. Malig, City Hall, Archt. Noted May 28.

Que., Montreal—U. H. Dandurand, 101 Notre Dame St. W., will soon receive bids for the construction of a 5 story, 114 x 252 ft. garage on Drummond St. Estimated cost $300,000. Ross & MacDonald, Belmont St., Archts.